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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 16. FRIDAY, OCTOBER 20, 1905.

The new Westinghouse quick-service triple valve is as important an advance in the art of freight-train braking as was the high-speed brake in passenger service. This is shown by the results of the August train tests made at West Seneca, N. Y., which are printed in this issue. These tests proved four things: That the quick-service triples will stop a 50-car train in 35 per cent. less distance than the standard triple valves when both are set with a full service application; that a light application made with a reduction of 5 lbs. in the train-pipe pressure will stop a 50-car train equipped with quick-service brakes in substantially the same distance as the standard triple valves when set with full service application with a reduction of 20 lbs. in the train pipe pressure; that it is possible to release brakes at low speeds when the train is equipped with these improved valves with greatly reduced draft-gear stresses; and that the new form of valve works in entire harmony with the standard triples. The good results due to their use are in proportion to the number of improved valves in the train. The underlying principles which make possible these results are as follows: By reason of the perfect and rapid equalization of pressure in all of the brake cylinders from the first car to the last, every brake in the train does its full share of the work of retardation. This action is as rapid as the emergency action. The ability to make a heavy service application on a 5-lb. reduction in the train pipe is due to the progressive wave motion of the air pressure throughout the train pipe. The initial reduction at the engineer's brake valve actuates the triple on the first car which in turn reduces the pressure in the train pipe behind it by admitting some of the train pipe pressure into the brake cylinder to do useful work. This successive reduction is rapid and continuous, and is as effective on long trains as on short ones. The retarding feature which has been introduced permits the release on the rear cars first, advantage being taken of the friction in the train pipe which reduces the pressure in almost direct proportion to the distance from the main reservoir supply. With the new valve a slightly reduced pressure gives a quicker release than the full reservoir pressure, hence the rear cars may be released before the forward cars, thus keeping the slack bunched and preventing jerking and break-in-twos. The value of the new valve is not that it adds much additional safety, for the emergency feature remains as before, but it improves operating conditions with long trains where the standard air-brake apparatus has often proved troublesome and unreliable. The Safety Appliance Act requires more brakes on trains. The new triple valve makes it possible to comply with the law safely and economically.

The Baltimore & Ohio is said to have notified the Lake Shore that it will not load any more cars with coal for points on the Lake Shore until that company returns about 1,000 cars belonging to the B. & O. It is further said that these 1,000 cars have been held by the Lake Shore for more than 30 days. It is unnecessary to investigate the truth of these statements in order to discuss a condition which is not uncommon. Some little additional significance attaches to this incident because Mr. Arthur Hale is not only General Superintendent of Transportation of the Baltimore & Ohio but is also Chairman of the American Railway Association's Car Service Committee, and, therefore, in his function as an executive he is applying in practice his own precepts as a committeeman in reforming abuses in car service. Here is an incident, one of many, where the coal shippers and coal receivers are at war with the railroads in a time of threatened car famine for the purpose of getting and holding for their own convenience as many cars as possible. The interests of the public, the users of the coal, are not identical with those of the shippers and receivers of the coal. These traders are at war with each other and with the railroad. When dealers in one region, foreseeing a shortage, order and hold cars beyond their storage capacity and until it is convenient to unload them, they interfere seriously with the interests of other consignees. It is the business and the direct interest of the railroad to prevent such abuses. A government bureau which could be called upon in these emergencies to abandon for a moment a consideration of the complaints of the Cincinnati Shippers' and Receivers' Association that rates from Richmond to Atlanta are too low in comparison with the rates from Cincinnati to Atlanta, or the complaints of the California fruit growers that the Florida business is being unduly nursed—such a bureau would be, indeed, a comfort to Mr. Hale under these circumstances, provided they were all wise and capable of considering the interest of the consumers as well as that of the traders. Until he gets such help from the government, however, he will probably need to continue to perform the functions of a transportation officer.

On another page we give a Frenchman's conclusions drawn from a study of American locomotive practice. The opinions expressed will be found to show a clear perception of the underlying

principles which have caused American and European locomotive designers to develop their art along diverging lines. The American designer is usually a manufacturer. The competition under which he works makes it necessary to produce a locomotive which shall be simple in design so that it can be economically built and easily maintained. In the construction solidity must be obtained; and the designer must bear in mind Wellington's maxim that, "An engineer is a man who can do for one dollar what any fool can do for two." When built the locomotive must be capable of giving hard service under a superintendent of motive power who has no personal interest in proving that the locomotive is of a type and design entirely suited to the service. Consequently the American locomotive must stand or fall on its own merits. There is consequently an effective evolution constantly going forward and selection plays a larger part in locomotive development than is possible in Europe, where the locomotives are for the most part designed by the railroad officials. Under these circumstances personal ideas are fostered and there is always a temptation to introduce new designs rather than to make use of devices which have become commonplace by general use. From many European sources criticisms of American locomotives have been heard, and it is therefore refreshing to hear an appreciation from a non-American source. The low price at which American locomotives can be built has been attributed to inferiority of design and materials. The truth is, as Mr. Oudet points out, that cheapness of production is obtained by simplicity of construction.

WHAT SHOULD DIRECTORS DIRECT?

Of late years, whenever a defalcation or wrong doing by the executive officers is brought to light, it has been common for the public to revile the board, and the word pictures of the newspapers show us a collection of successful but senile gentlemen, who have made money in yeast or leather or corsets or hams, who doze in their chairs while the President sells the company's securities in an attempt to corner something, or the Cashier rifles the safe to play the races. This picture is true of some small proportion of the 3,500 steam and electric railroad corporations, the 18,800 banking and trust companies, the 1,700 insurance companies, and of the uncounted thousands of very large and very small corporations which may be generally classed as industrials; but is there enough of it to justify a general overhauling and readjustment of directors' duties? The function of the director in an American corporation differs radically from that in other countries, with perhaps only one feature in common, namely, that some are apt to be chosen for the value which their names or reputations are supposed to add to the dignity or credit of the corporation. Our common idea of the duty of a board is that it shall control and direct the policy of the company and consider and pass on all undertakings of sufficient importance to in any way affect the company's financial credit or standing in the community. The occasion for the present general interest in the subject is the development of the carelessness of the directors of the Equitable Life Assurance Society and the shocking incapacity of the president of the Mutual Life Insurance Company. The text is the following misleading paragraph from the testimony of Mr. Jacob H. Schiff, a recent director in the Equitable:

> "The system of directorship in great corporations of the City of New York is such that a director has practically no power. He is considered, in many instances, and I may say in most instances, as a negligible quantity by the executive officers of the company; he is asked for advice when it suits the executive officers, and if, under the prevailing system, an executive officer wishes to do wrong or wishes to conceal anything from his directors or commit irregularities, such as have been disclosed here, the director is entirely powerless; he can be used only in an advisory capacity and can judge of only such things as are submitted to him."

This, which has been quoted generally by the daily newspapers, is unduly alarming to the investing public. Mr. Schiff is no longer young. He is a director in 16 companies, and senior partner in the firm of Kuhn, Loeb & Co., over whose immense financial transactions he undoubtedly keeps close watch. He had no investment in the Equitable, not even an insurance policy, so that we may assume that he was wanted in the board primarily for the appearance of stability which his name lent to it. It is also fair to assume that he accepted believing that he would be called on for advice and was competent for such advice in the company's large financial transactions.

But we believe that this is not all that the American investing public are led, by custom, to expect from a director. It is at least quite near the truth that we expect from directors, who commonly appoint the officers, a considerable degree of watchfulness of those officers and a close inspection of the results of their work—the details of the expenses which they incur and of the income which they get for the company. This, in addition to a direction of the general policy and scrutiny of the finances and credit, is about all that we, American fashion, expect from the directors—that by them the officers are "judged out of the things which are written in the books, according to their works."

The duty of the British railway director goes much further. To quote from the same authority: He is one "that fashioneth the hearts of them all, that considereth all their works." He is a salaried man, usually, really an officer. The committees of the board, assigned to each department, haunt the department offices, ask questions and call for special reports. "Where is your authority for having this office repapered?" "Why did you put in a concrete wall?" "How much did you pay for that asbestos lagging?" "What is this 'ton mile' that the Americans keep? We don't seem to have any of them." The British manager likes to answer this last question, but, on the whole, the British officer is bored by this minute directing. It has its value, it is often suggestive, but it consumes time.

Some American railroad officers are expressing fear that the late developments of laxity may inspire their own conscientious directors to interfere in technical matters. The chief engineer does not like to have his detailed plans criticised and changed by directors after they have authorized him to spend a certain sum of money to accomplish a specific purpose. He thinks he knows better than they know how to design an engineering structure to serve the end which they desire—and he is surely right.

The good results of the insurance companies investigation are already apparent in wakening the consciences of directors, but we hope it will be to the end of greater watchfulness of the results of officers' work and greater care in choosing, promoting and discharging those officers, rather than interference with them. Judge Gary, who is conscientious, has lately said to his fellow directors in the United States Steel Corporation:

> "We have no right to neglect our duties as directors, and I for one intend to give more attention to the affairs of this company in the future than I have in the past."

The converse of this confession by Judge Gary is that men of position who lend their names without fully performing their duties as directors do a great wrong. Their highest duty and most serious responsibility is in appointing officers, in promoting from the inside so far as possible, in making or reforming the organization so that it will work efficiently and without friction, in watching intelligently the results of the officers' work and infusing enthusiasm and loyalty. This is a fine function for sages, and fortunate is the corporation which has such a board of experienced men.

Deficient and incompetent men in such a board will be tempted to go farther and in the wrong direction, to criticise in detail the mechanical and civil engineering structures and operating methods of their own chosen men, trained and expert in technical departments. We have never happened to know of an instance where such interference does any good. The time of earnest, busy, officers is apt to be consumed in argument and kindergarten instruction, without a corresponding benefit to the company.

A MATTER OF STANDARDIZATION.

Is trouble brewing, or what will be the result of the apparent determination of the New York, New Haven & Hartford to haul its suburban trains as well as its express trains to the new Grand Central Terminal, in New York, with alternating-current locomotives? This involves two variations from the New York Central's methods on the same tracks, namely, locomotives instead of motor cars for suburban trains, and locomotives designed primarily for a. c. instead of d. c. operation. It was announced in these columns three weeks ago that the New Haven Company has ordered for this service 15 78-ton locomotives, with alternating-current series motors, adapted for use with an overhead trolley system, but capable of using the direct current taken from a third rail. Between Woodlawn and Grand Central Station the New Haven trains come into the city over the New York Central tracks, where the direct current is to be used. In an article on single-phase electric traction, published in these columns last week, the engineer of the Westinghouse Electric & Mfg. Co., Mr. C. W. Scott, concludes: "It is best, therefore, to keep single-phase equipments free from operation on direct current if it be practicable to do so." It is uneconomical, it is possible but not certain of uniform good results. The answer to it might be something like this:

(1) This proposed use of alternating current equipment in direct current territory will require more energy when running at slow speeds than similar equipment of the d. c. type, thus placing a load on the transmission system and sub-stations of the New

York Central not originally contemplated, and also largely increasing the cost of operation.

(2) The state of the art is such that the practical use of a. c. equipment will require many months for a proper development of untried devices, which will delay the installation of the New Haven equipment beyond the fall of 1906, when the New York Central expects to change from steam to electricity in its electric zone. The public expects the New York Central to keep its promise of an early discontinuance of steam locomotives through the Park avenue tunnel.

The New Haven Company is the New York Central's tenant, under a lease and agreement made in 1848. The New Haven Company has running rights over the New York Central line from Woodlawn to Grand Central Station, but must do its own hauling. It has always heretofore used the method of hauling adopted by its landlord. As long as the Central stopped its locomotives at Thirty-second street and hauled its passenger cars by horse power to City Hall, the New Haven did the same. Electric traction was not contemplated in 1848, and when nearly three years ago the New York Central, in response to public sentiment, accepted the act of legislature authorizing it to change its power, it appointed an "Electric Traction Commission" composed of men who had earned the respect of the whole country. After years of study this commission decided to use the direct current and the third rail, but expressly disclaimed any intention "to pass upon the relative merits of alternating current or direct current railroad operation as a general proposition." It simply decided that the local conditions precluded the use of the alternating current. Since this conclusion was arrived at, the commission has controlled every detail of the work—the electrification on the main line and the Harlem division, and the enlarged Grand Central Terminal with its surface tracks for trains hauled by electric locomotives, and its sub-surface tracks for a suburban service of multiple-unit train operation so as to obviate reverse movements and the switching incident to locomotive operation.

There are loops in the sub-surface part of the terminal, but they are not designed for locomotive operation and are not suited for it. Nevertheless the New Haven Company now proposes, under its agreement for running rights and authority to haul its own trains in its own way, to use 78-ton electric locomotives to bring its suburban trains to this terminal.

There may arise, therefore, a nice question of law, or, rather, a difficult judicial interpretation of a contract made 57 years ago, and its application to a state of things not then conceived of. What was the spirit of that contract? Since the combined forces of public opinion and the authorities of the state and city of New York have compelled the New York Central to desist from using steam power in the Park avenue tunnel, can the New Haven enforce its agreement and use steam locomotives in the city? Granted that the New Haven cannot do this, because locomotive smoke has been declared to be a nuisance, has the New Haven a right to abate the smoke nuisance by substituting mule power, and compel the Central to pave its tracks so as to make it comfortable for its mules? If it is answered that this would be unlawful because it would be inimical to public convenience, economy and despatch, it is apparent that the same objection holds good, in a less degree, to the New Haven's a. c. motors which will overload the transmission system and sub-stations of the New York Central. Locomotives for suburban trains in the sub-surface track would be more troublesome than mules.

There is a double-track loop, with which all tracks are connected. This design permits of operation as a stub-end terminal (the motor-driven train reversing direction and running back on its own incoming track), or running around the loop. The locomotive-hauled train has no alternative, and the further objection to it is that the loop is 135 ft. radius, and therefore impracticable for a 10 or 12 car locomotive-hauled train.

Another lamentable feature of a failure of the two companies to agree and standardize their stock in this electric zone is that it will prevent a pooling of equipment for common use. This provision for a highly probable economy and convenience to the public has been by both companies considered desirable.

If the New York Central, or its Electric Traction Commission, has been autocratic; if it has failed to invite and urge the New Haven officers to consult in all matters which affected them; or if it has omitted to invite them to have representatives in the Commission, the New Haven might by so much (very little) feel justified in avoiding, as a matter of personal feeling, an economical standardization; but we have no reason to believe that there was such a cause or such an undignified result. In any event, we earnestly hope that the success of this, the greatest undertaking of its kind, may not be imperilled by a failure to agree on standards for electric suburban cars and for the use of electric power.

It is not intended in this discussion to disparage the use of the single-phase alternating-current series motors, and the overhead trolley system for heavy traction. Its economy is unquestioned and its future use is certain, so far as we can see, at least for single and double track lines. But when an expert commission, quite unbiased, has after years of study decided that local conditions preclude its use in the New York Central terminal, the New York, New Haven & Hartford can well afford to deliberate before seriously interfering with the success of this monumental reconstruction for the public convenience.

Railroad Gross Earnings in August.

Gross earnings in August reflect the continued condition of the general prosperity of the country which was evident in the figures for July earnings. The increases in August over the figures for the corresponding period of 1904 mean much more than the July increases did, because in July, 1904, the great majority of roads reported decreases as compared with 1903, while in August, 1904, business conditions were recovering from the July depression and the majority of roads showed increases over 1903.

Of the Trunk lines, eight roads show gross earnings of $40,337,408, an increase over the figures for August, 1904, of $3,478,749; 9 per cent. Conditions have been especially favorable for these roads; the total receipts of grain, flour and corn meal at New York during this month aggregated 10,115,599 bushels, as against a corresponding movement in 1904 of 8,706,240 bushels, and the increases in similar receipts at Philadelphia were in about the same proportion. In the Southern group, the gross earnings of nine roads are $17,841,425, an increase of $554,052; 3 per cent. The full force of the yellow fever embargo at New Orleans was felt during August, and the ensuing reduction of traffic also affected roads which did not reach New Orleans but handled traffic originating there. The Coal roads show the largest percentage of increase of any group. Nine roads report gross earnings of $15,349,502, an increase of $1,970,093; 15 per cent. The coal and coke traffic originating on the Pennsylvania lines east, during the five weeks ending September 2, amounted to 4,363,756 tons, as compared with 3,677,589 tons in 1904. Of the Granger lines, six roads show gross earnings of $12,663,949, an increase of $1,157,543; 10 per cent. The receipts of live stock at the important cities in the region covered by these roads were only slightly greater than last year, but the grain movement was much greater; receipts of grain at Chicago being nearly 3,000,000 bushels (about 10 per cent.) greater than in 1904. In the Southwestern group, the gross earnings of six roads amounted to $18,884,043, an increase of $1,155,369; 7 per cent. These roads were still suffering in August, 1904, from the effects of the beef strike. The Transcontinental roads, like the Trunk lines, show the effects of the general prosperity in their increased amount of through traffic, much of it being merchandise which would not be bought in hard times. Of this group, five roads report gross earnings of $25,398,687, an increase of $2,658,960; 12 per cent.

The more noticeable increases and decreases in the earnings of individual roads can be explained by the conditions which affect the groups of which they are a part. All the roads which last year had great increases in passenger traffic on account of the St. Louis Fair of course show the effects of the lack of that traffic this year.

The accompanying table shows the gross earnings for August, 1905, and the increase over the figures for August, 1904, of 46 roads:

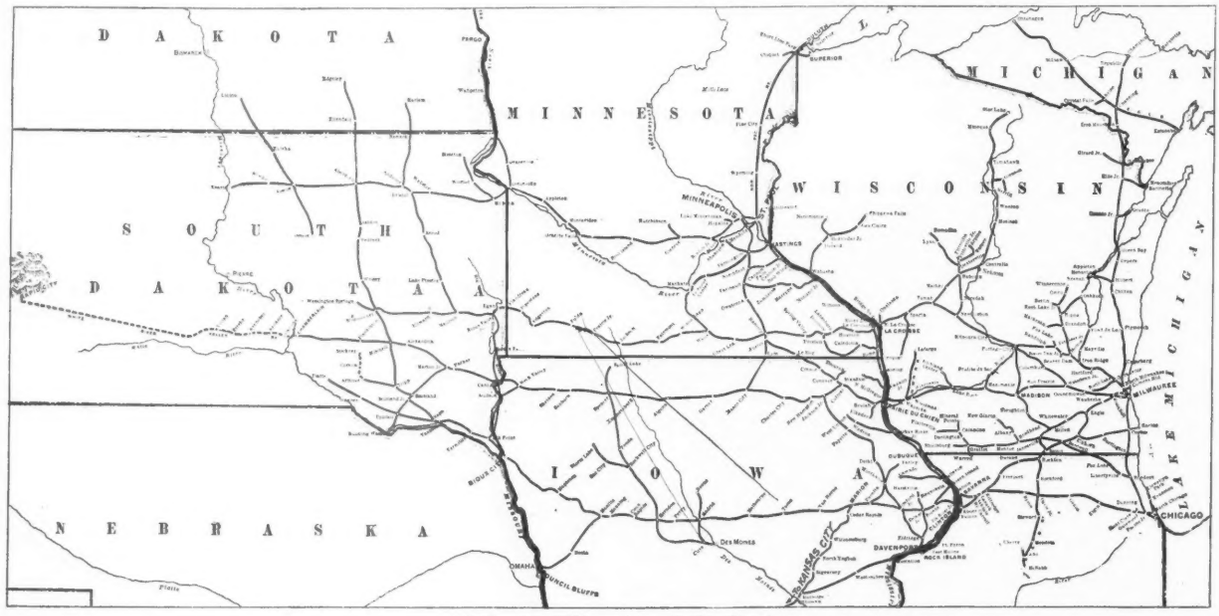
	August, 1905.	Increase over August, 1904.
Atchison, Topeka & Santa Fe	$5,967,032	$522,698
Atlantic Coast Line	1,612,763	158,767
Baltimore & Ohio	6,398,087	527,735
Buffalo, Rochester & Pittsburg	806,567	71,351
Canadian Pacific	4,796,734	322,496
Central of Georgia	827,820	101,828
Central of New Jersey	2,248,388	268,813
Chesapeake & Ohio	1,967,281	147,500
Chicago & Alton	1,056,300	*136,764
Chicago Great Western	714,364	89,169
Chicago, Milwaukee & St. Paul	4,467,405	262,351
Chicago, Rock Island & Pacific	4,481,592	584,778
Chicago, St. Paul, Minn. & Omaha	1,028,980	51,278
Cin., New Orleans & Tex. Pac.	665,467	39,281
Clev., Cin., Chic. & St. Louis	2,158,266	32,168
Colorado & Southern	596,492	105,743
Denver & Rio Grande	1,690,261	265,284
Erie	4,406,759	302,880
Grand Trunk	2,647,130	75,175
Great Northern	3,972,540	334,649
Hocking Valley	575,791	*33,682
Illinois Central	4,015,835	*198,373
Lehigh Valley	2,836,038	425,721
Louisville & Nashville	3,402,605	180,236
Mexican Central	2,294,684	204,788
Mexican International	511,637	*38,834
Minn., St. Paul & Sault Ste. Marie	916,308	306,731
Missouri, Kansas & Texas	1,722,633	191,811

Missouri Pacific-Iron Mountain....	$3,734,000	*$173,000
Nashville, Chattanooga & St. Louis	872,772	*15,989
National R. R. of Mexico.....	539,196	66,167
New York Central & Hudson River	8,146,196	824,926
New York, Ontario & Western....	782,954	80,384
New York, Susquehanna & Western	245,699	34,189
Norfolk & Western	2,394,003	437,794
Northern Pacific	4,903,644	532,470
Pennsylvania Lines East of Pittsb'g	11,967,490	1,667,600
Philadelphia & Reading	3,492,781	538,023
Pitts., Cin., Chic., & St. Louis	2,361,778	277,348
St. Louis & San Francisco	3,552,474	140,040
St. Louis South-Western	718,875	4,737
Southern	4,258,535	216,983
Southern Pacific	8,591,941	812,565
Union Pacific	5,758,737	946,647
Wabash	2,251,702	*229,083
Yazoo & Mississippi Valley	461,055	*120,491
Total	$133,820,530	$11,206,888

*Decrease.

Chicago, Milwaukee & St. Paul.

The St. Paul, with an operated mileage of 6,900 miles, covers the territory west and north of Chicago, including lines to Minneapolis, St. Paul, Duluth, the Michigan peninsula, Kansas City, Omaha, Evarts, S. Dak., and Fargo, N. Dak. Through northern Illinois, Iowa, southern Minnesota, Wisconsin and the eastern part of South Dakota its lines spread widely. One of the farthest western points now reached by the St. Paul is Chamberlain, S. Dak., 682 miles from Chicago. The construction of a line from Chamberlain, 75 miles west to Rapid City, now under way, has led to some very definite rumors of a further extension, when this is finished, between the Union Pacific and the Northern Pacific, to the coast. Belief in the ultimate purpose of the St. Paul management to reach the coast over its own rails has been strengthened by the fact that the road has not, it is believed, been getting its share of through traffic (its average haul on a mileage of 6,912 miles decreased from 185 miles in 1904 to 175 miles last year), and by the fact that there is unissued in the treasury $25,000,000 common stock which would provide funds for the extension. The large stretches of undeveloped territory between Rapid City and the coast, which could not fail, profited by railroad development, to eventually furnish a large local traffic, give a further argument for the extension.



Chicago, Milwaukee & St. Paul.

Aside from its possible aspirations for a coast connection, the St. Paul is prosperous in its present territory. Gross earnings last year nearly reached the fifty million mark, being $49,884,114 against $48,330,335 in the preceding year, an increase of $1,553,779. The fact that earnings for 1904 increased $667,597 over 1903 shows how large last year's increase really was. The striking fact about the year's operation is not only the large increase in gross but the large proportion of this increase saved for net earnings, which increased $1,136,328 over 1904, being $17,590,073 in 1905 and $16,453,745 in 1904.

Last year the company's statement was severely criticised because of the very large reduction in maintenance of way expenses and the serious increase in the expense of conducting transportation. Maintenance of way cost, in 1904, $5,128,248, against $7,347,048 in 1903, a decrease of $2,218,800 in one year in expenditure on the line. In the same time, conducting transportation increased $1,767,547; from $16,829,795 in 1903 to $18,597,342 in 1902. This would make a bad showing for any road and in consequence the results last year, though apparently satisfactory, were in the expense account largely disappointing. Furthermore gross earnings were not increasing at the rate which might have been expected, so that the underlying condition was doubly unsatisfactory. During the past year these unfavorable factors have to some extent been overcome. The large increase in gross earnings has already been noted. Maintenance of way, though over $2,000,000 less than in 1903, increased $280,378, to $5,336,626. This is at the rate of $773 per mile of road against $751 in 1904 and $1,099 in 1903. Conducting transportation, though still nearly $1,500,000 more than the 1903 figure, also decreased $316,884. The large increase in gross business makes the showing in this account better than the figures seem. Yet, although gross earnings show a remarkably satisfactory increase, expenses do not appear to be yet in hand and the bad results in 1904 have been only partially, and that but a small part, overcome.

The saving in conducting transportation is more than explained by a decrease of $379,292 in fuel for locomotives, brought about, no doubt, by the completion of the company's line into the Illinois coal fields. With this exception, conducting transportation cost the company a great deal. Station service increased $49,111; advertising $33,110; outside agencies $32,249; rents for tracks and terminals $44,676, and loss and damage ($479,437) $143,488. In 1904 conducting transportation was 38 per cent. of gross earnings against 33 per cent. in 1901. With the large increase in gross and the small decrease in this expense account, this relation was reduced to 37 per cent. last year. Following the showing made in 1904, these figures can hardly be regarded as satisfactory, and it is probable that a still greater effort will be made during the current year to get expenses on a more satisfactory basis.

Maintenance of equipment during recent years seems to have been fairly well, though not liberally, taken care of. A satisfactory fact is that it has been increasing year by year. Repairs and renewals cost $1,538 per locomotive last year against $1,493 per locomotive in 1904 and $1,232 per locomotive in 1903. Per passenger car there was spent $592 in 1905, $531 in 1904, and $544 in 1903, and per freight car $42 in 1905, $38 in 1904, and $36 in 1903.

While current maintenance charges are not as liberal as might perhaps be expected, the company's policy in regard to improvements is highly conservative. During the year there was expended from the renewal and improvement fund $6,704,127, leaving a balance of $3,966,106 in this fund at the end of the year. In 1904 there was $5,914,372 spent from this fund for betterments. Independently of the fund there has been spent out of current cash, but charged to capital account as "earnings and other income expended for additions and improvements to property," since 1902, $18,222,631 and in the past year $2,867,699. This is a remarkable record for improvement expenditures which could be matched by few other roads. It would seem natural that the effect of these very liberal outlays on expenses should soon be more clearly shown.

The company maintains its own insurance department and has evidently during the past year changed its attitude in regard to some of the larger risks, influenced no doubt by the severe losses of the Illinois Central in the New Orleans fire, which amounted to within $600,000 of the total reserves against loss in that company's insurance department. An item of $45,355 expended

by the St. Paul as re-insurance from March 16 and 18, 1905, for one year, suggests that the larger risks were at that time re-insured with regular fire insurance companies.

Traffic statistics show that there was a decrease of 209,638 tons of wheat and 143,927 tons of miscellaneous forest products, and increases of 314,482 tons of corn, 91,791 tons of oats, 942,674 tons of iron and other ores, 182,422 tons of stone and sand, 146,349 tons of lumber, lath and shingles, and 179,392 tons of iron and steel, in the tonnage carried during the year. Wheat furnished 5 per cent. of the total tonnage and products of agriculture 23 per cent. Products of mines furnished 28 per cent. against 24 per cent. in 1904. There were 2,473,150 tons of bituminous coal carried, an increase of 93,402 tons over 1904. The train load increased from 246 tons to 264 tons; or, including company freight, from 280 tons to 296 tons. The rate received per ton mile was 0.881 cent against 0.891 cent in 1904, and per passenger mile 2.243 cents against 2.305 cents in 1904. The average number of miles each passenger was carried was 44 miles.

With its 6,912 miles of track, the Chicago, Milwaukee & St. Paul secures less than 500 miles haul on through freight via either Minnesota Transfer or the Omaha or Kansas City gateways, for it is not likely that the Great Northern, Northern Pacific or the Minneapolis, St. Paul & Sault Ste. Marie turns freight over to it west of Minneapolis for a longer haul. This will probably be the determining factor in deciding upon an extension to the Pacific coast. Why the Chicago, Milwaukee & St. Paul is any more compelled than the Chicago & North-Western to make such an extension is not at first sight clear, but an examination of Chicago & North-Western returns shows that not only does that company serve its own territory more completely and more profitably, but hints at the fact that through affiliations of ownership or for other reasons it is able in general to obtain a considerably better share of through traffic.

The principal statistics of operation follow:

	1905.	1904.	1903.
Mileage worked	6,912	6,906	6,683
Freight earnings	$35,968,946	$35,081,759	$34,797,045
Passenger earnings	10,126,958	9,661,633	9,542,201
Gross earnings	49,884,114	48,333,335	47,662,738
Maint. way and structures	5,336,626	5,128,249	7,347,048
Maint. of equipment	5,181,586	4,651,783	3,893,834
Conducting transportation	18,280,458	18,597,343	16,829,796
General expenses	1,243,079	1,190,907	952,309
Operating expenses	32,294,041	31,876,590	31,598,174
Net earnings	17,590,073	16,453,745	16,064,563
Gross income	50,114,912	48,646,766	48,172,768
Net income	11,858,825	10,718,400	10,473,259
Surplus after dividends	4,371,114	3,277,169	3,072,033

NEW PUBLICATIONS.

Mechanics of Materials (Tenth Edition). By Mansfield Merriman, Professor of Civil Engineering, Lehigh University. New York: John Wiley & Sons, 1905. Cloth, 6 in. x 9 in.; 507 pages; 183 figures. Price, $5.

In presenting the tenth edition of this work the author states that while his main purpose in re-editing and enlarging it has been to keep it abreast with modern progress, he has at the same time attempted to present the subject more clearly and logically than before, in order both to advance the interests of sound engineering education and to promote sound engineering practice. The same general treatment of the subject is followed, in a similar manner, as in the past editions, although various topics have been treated more at length than before and the sub-divisions are somewhat different. There are 19 chapters and these are devoted to the following subjects: Elastic and Ultimate Strength, Elastic and Ultimate Deformation, Materials of Engineering, Cases of Simple Stress, General Theory of Beams, Simple and Cantilever Beams, Overhanging and Fixed Beams, Continuous Beams, Columns or Struts, Torsion of Shafts, Apparent Combined Stresses, Compound Columns and Beams, Resiliance and Work, Impact and Fatigue, True Internal Stresses, Guns and Thick Cylinders, Rollers, Plates and Shears; Miscellaneous Discussions, and Mathematical Theory of Elasticity. To encourage students to think for themselves and to illustrate the practical use of the formulas and methods which are given in the text, a number of examples are given after each article. Among some of the new topics introduced are those of economic sections for beams, moving loads on beams, constrained beams with supports on different levels, the torsion of rectangular bars, reinforced-concrete beams, plates under concentrated loads, internal friction, rules for testing materials, and elastic-electric analogies. A number of good practical tables, such as the working unit-stresses for buildings, which are abstracted from the Building Code of the City of New York, are also given.

Design and Construction of Metallic Bridges. By William H. Burr and Myron S. Falk. New York: John Wiley & Sons. 1905. Cloth, 532 pages, and 4 plates. Price, $5.

Burr's "Stresses in Bridge and Roof Trusses, Arched Ribs and Suspension Bridges" has long been a standard text-book on the analytical methods of computing the stresses in framed structures. After having passed through nine editions and revisions it makes its appearance under this new title completely rewritten and enlarged in scope. American bridge design has advanced rapidly during the last few years and many of the old types and methods of computation have become obsolete. The types of structures considered in this new work represent only those which have survived the test of time, and the methods of design are those in general use among the more advanced bridge engineers. Less space than usual in a book of this kind has been devoted to the complete solution of a number of different types of bridges, more attention being paid to the special problems involved in the design of all types such as wind load, effect of centrifugal force, full treatment of moving loads and similar problems which come up every day in practical bridge design, but which are too frequently dismissed in most text-books with only passing mention. The design of swing bridges has been very fully treated, more than 120 pages being devoted to this one class of structures. Other chapters deal with the history of bridge building, design of plate girders, trusses with parallel chords, trusses with chords not parallel, influence lines, theory of least work, wind stresses in roofs and braced piers and details of bridge construction. The book shows evidences of having been hurried through the printer's hands as there are a number of minor typographical errors in the text and the printing is hardly up to the publisher's standard.

TRADE CATALOGUES.

Hoisting Machinery.—The Brown Hoisting Machinery Company, Cleveland, Ohio, sends its 1905 "Brownhoist" catalogue. It measures 9 in. x 12 in. and is handsomely bound in cloth and contains upwards of 200 pages. Descriptions and illustrations are given of the latest machines of the "Brown" type for unloading coal or iron ore from boats and delivering it either into railroad cars or on stock piles, and vice versa, and for the hoisting and conveying of general merchandise at docks, steel works and blast furnaces; also for the handling of material during the construction of ships at ship yards. It also illustrates and describes the Brown furnace hoist and stock distributor for the charging of blast furnaces, besides many other equipments for the handling of material in the yards of steel works, structural shops, etc. The "Brownhoist" suspended pocket is also illustrated, this construction being used in connection with the charging larries in many of the largest steel works.

Locks and Hardware.—The Yale & Towne Mfg. Co., New York, sends its catalogue No. 18, which contains over 200 pages, 6 in. by 9 in. It is neatly bound in green board covers, with red cloth back and gold lettering. It lists and prices only goods most commonly called for, and is intended for a book of ready reference for both large and small buyers. In addition to cataloguing padlocks, night latches, builders' hardware, door checks, chain blocks, etc., it contains a comprehensive glossary of technical terms and articles of interest on the mechanism and care of locks, lock picking, master-keyed locks, etc. Almost every article mentioned in the volume is shown by illustrations and is explained by descriptive text indicating its action, its use and its relative grade.

Car Heating and Lighting.—The Gold Car Heating & Lighting Company, New York, is distributing a large new catalogue of its car heating and lighting apparatus. The devices shown embody many improvements in design and construction and are the latest types made by this company. They include direct and hot water systems of car heating, storage heating system for compartment passenger cars and refrigerator cars, and a complete line of electric heaters. All the parts shown are identified with list numbers so that the catalogue may be used for ordering new or duplicate parts.

Electric Batteries.—The Gordon Battery Co., New York, sends an illustrated catalogue and price-list descriptive of its electric batteries, cells and spark coils. Special attention is called to the improved Gordon batteries, in which a perforated cylinder containing the copper element is provided. This improvement will be especially appreciated by users of primary batteries as, when renewing the same, the necessity of handling the parts which were immersed in the solution is entirely obviated.

General Supplies.—Joseph T. Ryerson & Son, Chicago, sends its October issue of "Ryerson's Monthly Journal and Stock List." It contains several short articles, including "The Setting and Care of Air Compressors" and "The Economical Arrangement of Machinery," as well as the usual number of convenient tables of weights, etc., of various shapes of rolled steel sections and plates.

Automatic Couplers and Draft Rigging.—The W. T. Van Dorn Co., Chicago, sends an illustrated catalogue of the Van Dorn Automatic Couplers and radial draw bars. Full detailed descriptions of the above devices, including working drawings, are given. Illustrations are also shown of an eight-car train of steel motor cars on the New York Subway, which are equipped with the Van Dorn drawbar.

CONTRIBUTIONS

A New Track Book.

Montreux (Switzerland), Oct. 6, 1905.
Pension Grammont.

TO THE EDITOR OF THE RAILROAD GAZETTE:

After reading the Etude sur les Déformations des Voies de Chemins de Fer et les moyens d'y remédier par M. G. Cuënot, Ingénieur en Chef des Ponts et Chausseés, attaché au controle de la Compagnie P. L. M. (Eng. Bertéa, Imprimeur Editeur, Bourg (din) France), I think close attention of American maintenance of way engineers who understand the French language ought to be called to this book, which appears to me to be the most interesting and instructive work published up to date. MAX BARSCHALL.

A Runner's Ideas on Signaling.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Noting the article on Forms of Signals in your issue of September 29, and in the following issue comments on it by a "President," a "Vice-President" and others, I should like to say something from the viewpoint of the locomotive engineer. The article says:

> "In view of the facts that railroad signals are now intended to tell so many different things, some logical variations in their form will soon be quite necessary, or the engineman's memory will be overtaxed. . . . Signal indications may be enumerated as follows:
> 1. Switch signals.
> 2. Draw signals.
> 3. Automatic signals.
> 4. Unusual route signals.
> 5. Train order signals.

He might have mentioned more. The different kinds of things the signals tell and the names of the different signals are mere terms by which fine distinctions of little moment to the engineman are made. The engineman knows little of technical names and differences and cares less; yet without effort he can describe his signals to the satisfaction of his immediate superiors.

I cannot see any practical difference between signals such as "interlocking," "distant switch," "manual block," "automatic block," "draw," "train order," "flag stop," and a goodly number of others that could be mentioned; but, since running over as many as four different Superintendents' division, the great lack of uniformity in the application of our present few and simple forms is apparent.

Accidents are rarely due to engineman's innocently misinterpreting signals, but frequently are due to his negligently misinterpreting, guessing, wittingly assuming, anticipating them for little or no reason or for making time. And you may always expect this weakness to crop out in the best of enginemen some time or other; the best protection against it is uniform application of signals placed as far apart as practicable and possessing few forms. Signals will necessarily become so close together that enginemen will have no time to reason as to their significances other than those of "Stop," "Go," "Go permissively," "Go, home signals are cleared up to the one in advance of the next distant signal." No expense should be spared to reduce rather than increase these terms. If the permissive signal were abandoned then our present forms would be ideal, as the distant signal could then take the form of the permissive and thus avoid the use of a special form of blade. If there is a fourth light practical then it should be given to the permissive so that its night indication will be different from the distant signal.

Outlying switches can be and should be protected as interlockings are and considered as unattended, with switches left straight and signals pulled. Manual block stations should be so well manned and signalled as to command as much confidence on part of enginemen as if they were interlocked; and can be considered interlockings with or without switches.

Automatic blocks are more than interlocked, provided the outlying switches are properly connected or mechanically or electrically controlled, and may be considered manual block stations. When the signals show "Stop" one may consider the attendant disabled.

Drawbridges should be treated as nothing more than derails at interlockings.

If it is thought that trains stopping at interlocking or block station signals cannot be safely and promptly communicated with as to train orders then do the thing right by placing the usual form of signals for each track in front of the cabin so that the operator may conveniently deliver orders. The engineer need not consider the signal in any other light than others.

Why cannot "flag stop" signals be located and operated much in the manner of block signals and so require no special form? A signal is a signal no matter what its size.

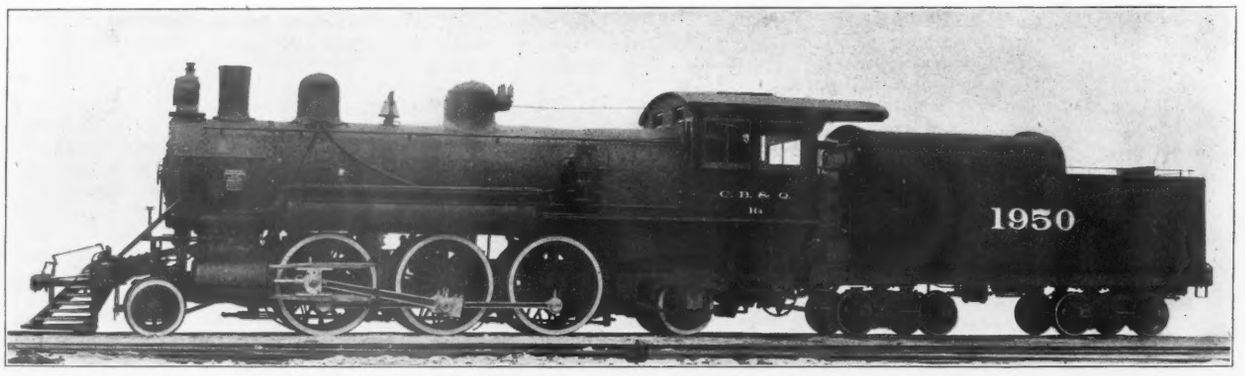
No matter what special marks or forms signals are given, the fact remains that to move safely and make time the engineman must know the locations of his signals so well that he is anticipating the sight of them. If he is so well acquainted with his road as to anticipate the sight of his signals then the special marks and forms have long since become useless to him.

When practicable, an engineman should never pass a "Stop" signal without an order; if this rule were enforced there would be little excuse for specially marking "automatics" anywhere. As it is, there is little use for these markers except where they are mixed up with signals controlled by an operator. There is no objection to day markers; unnecessary lights at night are always sources of danger. But whatever marks or forms signals may be given, they should be applied so that to the engineman the signals primarily mean either "Stop," "Go," "Go permissively," "Go, you have *go* signals up to the signal in advance of the next distant," or "Go, but there is now a stop signal between you and the next distant signal." An engineman satisfied that the operation of signals is surrounded with all the safeguards of the signal art can be depended on to regulate his speed according to these signal indications as well as in conformity to those many other features upon which speed depends, such as grades, curves, road crossings, bridges, stations, water troughs, schedule, condition of engine, make up of train, cattle or school children on track, condition of track, weather conditions, etc.; and particularly in accordance with the distance the signals are apart. In view of signals being only 30 seconds apart and every tenth signal a three-armed interlocking one, do you not think it would be better to refrain from giving the engineman occasion to study new frills until the present forms are uniformly adapted and universally understood? Then, it is my firm conviction, you will find the present forms amply sufficient.

If, on top of all this, speed signaling is to be mixed up with route signaling, the chances are that no present-day runner will, unpensioned, live to see the day of uniform signaling. Why not make the best of what we have rather than chase after a will-o'-the-wisp cure-all? A LOCOMOTIVE ENGINEER.

Prairie Type Engine for the Chicago, Burlington & Quincy.

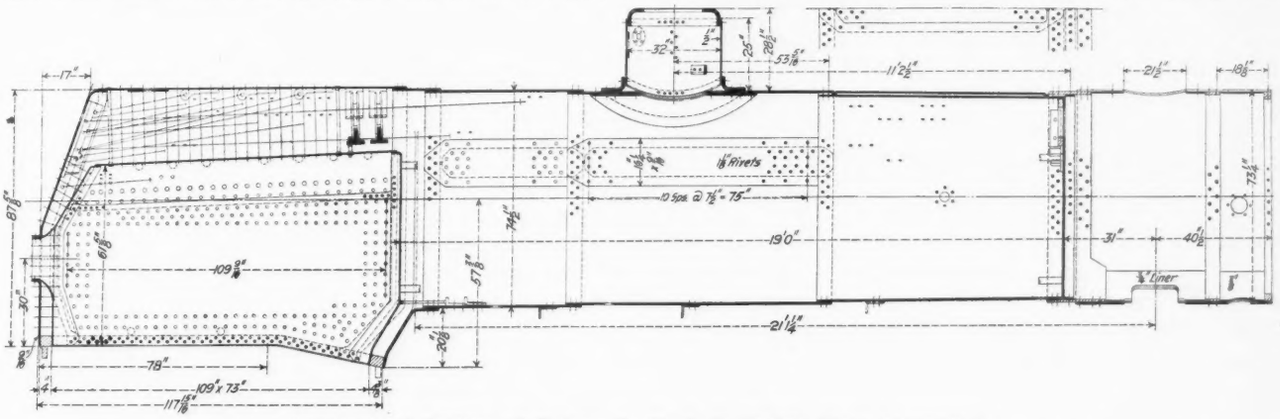
A few months ago the American Locomotive Co. delivered a number of prairie (2-6-2) locomotives to the Chicago, Burlington & Quincy that possess certain features of interest. In the first place, six of the fifty that were ordered were intended for burning lignite and therefore required a modification of the tube arrangement. The boiler used on the bituminous coal burning engines is shown in the longitudinal section. It contains 301 tubes 2¼ in. diameter and 19 ft. long over the tubesheets. They are arranged in the usual manner, with a pitch of 3 in. The boiler for burning lignite has but 198 tubes of 2¼ in. diameter and in addition thereto has 24 of 5 in. outside diameter, that are swaged down to 4 in. and screwed into the back tubesheet, and expanded at the



Prairie (2-6-2) Type Locomotive for the Chicago, Burlington & Quincy.

full diameter into the front sheet. These 24 tubes take the place of 103 small ones in the bituminous coal burning engines, and are located at the center and top as shown in the cross-section of the boiler. These large tubes are required in order to secure the proper condition of combustion of the light burning lignite.

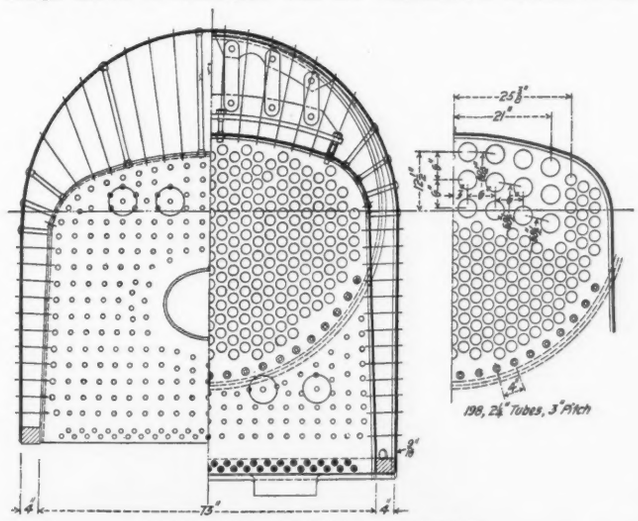
The back head is also somewhat peculiar in its construction. It slopes down to the top of the firebox from which point it is vertical. The inner sheet is flanged out to form the door but instead of the short, sharp bend usually employed it sweeps out on a radius of 11 in. thus avoiding the stresses to which it would ordinarily be subjected. At the same time the slope is much more rapid than that of the outer sheet, so that the water space instead of being 4 in. wide, as it is below the door, widens out to 9 in. at the crown, thus greatly improving the circulation.



Longitudinal Section of Boiler—C., B. & Q. Prairie Type Locomotive.

The grate is 108 in. long and is flat for 78 in. from the back and drops 7¾ in. in the remaining distance. The frames are in three sections, being bolted together just back of the cylinders and between the third pair of drivers and the trailing wheels. The equalization of the weights on the drivers varies, the load of the rear being normally greater than on the main pair. It will be seen from the illustration that the weights on the two rear pair of drivers and the trailing truck are equalized by bars with arms of unequal lengths. In this way about 22 per cent. more weight is carried by the rear pair than the main, while the truck carries 25 per cent. less than the latter. The forward drivers and the truck are equalized in the same manner as in consolidation and mogul engines. The back end of the equalizer over the trailing axle box is carried by a short elliptic spring instead of the helical spring that has found a place at the back end of American locomotive frames for so many years.

The support of the boilers on the frames follows the general design shown in connection with the consolidation locomotive for



Sections Through Boiler and Firebox.

the New York Central & Hudson River R.R. illustrated in the *Railroad Gazette* for June 9, with a slight modification. In that case the whole weight of the firebox was carried by two plates bolted to lugs on the bottom of the mud ring and which, by buckling, compensate for the varying dimensions of the shell due to expansion. In the boiler on the engine under consideration this buckle-plate is attached to the back end only, while the front of the firebox is carried by two feet bolted to the lugs of the mud ring and resting on a bracket extending across between the frames. The movement to and fro at this point takes place by sliding as in the case of the expansion plates that were used on the old narrow firebox locomotives.

In this boiler there is also embodied a method of making a butt lap welt on the horizontal seams with which some may not be familiar. It is shown in section and plan at the top of the front course in the longitudinal section of the boiler. In order to avoid the necessity of drawing down the metal and scarfing so as to carry the welt beneath the sheets the outside welt is made to butt against the next larger course plate back, and in the center, a ⅞-in. plug is screwed and riveted over, thus making the joint and bolting the back course plate, the outside and inside welts and the front course plate firmly together. It is one of the unnoticed details of the boiler practice that has been adopted for the purpose of adding to the efficiency of the work and at the same time saving expense.

In the arrangement of the stays for the side sheets of the firebox the diameter is ⅞ in. spaced about 3 7-16 in. apart, except at the ends. Here the row of stays next the back head have a diameter of 1 in. The same size is used in the lower front corner next the mud ring and up the sides next the tube sheet commencing on a line with the bottom of the shell.

In regard to the other details on the engine, the front and rear trucks are the ordinary two-wheeled radial truck and the standard outside bearing truck of the railroad company respectively. All of the journal boxes are of cast-steel as are the centers of the wheels themselves.

The tender frame is also of the standard C., B. & Q. construction, using 12-in. channels for sills. The brakes are the Westinghouse, with a 9½-in. pump, with the American type for the drivers, and having a reservoir of 60,000 cu. in. capacity.

The general dimensions of the engines are as follows:

Cylinder, diameter	22 in.
Piston stroke	28 in.
Tractive power	35,053 lbs.
Wheel base, driving wheel	13 ft. 4½ in.
" " total	30 " 8½ "
" " total engine and tender	62 " 2¾ "
Weight on drivers	154,000 lbs.
" total of engine	212,500 "
" total of engine and tender	366,500 "
Heating surface, tubes (bituminous coal)	3,343 sq. ft.
" " tubes (lignite)	2,940 "
" " firebox	170.9 "
" " total (bituminous coal)	3,513.9 "
" " total (lignite)	3,110.9 "
Grate area	54 "
Axle, driving journals	9½ in. diam., 12 in. long.
" engine truck journals	6 " " 10 " "
" trailing truck journals	8 " " 12 " "
" tender journals	5½ " " 10 " "
Boiler, type	Radial stay; Straight top
Boiler, outside diameter, first ring	70 in.
Firebox, length	109 "
" width	73 "
" thickness crown sheet	⅜-in.
" " tube sheet	½-in.
" " sides and back	⅜-in.
" Water space, front	4½ in.
" water spaces, sides and back	4 "
Crown sheet support	Radial stays with two rows of sling stays at the front
Steam pressure	210 lbs.
Tubes, material	Iron
" number	301 and 198
" diameter	2¼ in. and 5 in.
" length	19 ft.
Grates, type	Rocking
Smokestack, diameter	19½ in.
Smokestack, height above rail	15 ft.
Tank, type	Water Bottom
" capacity, water	6,000 gals.
" capacity, coal	16 tons
Valves, type	Piston
" travel	5¾ in.
" steam lap	1¼ "
" exhaust lap	¼-in.
Wheels, diameter of driving	69 in.
" " " truck	37¼ "
" " " trailing	42½ "
" " " tender	33 "
Ratio of total weight of engine to weight on drivers	1 to .724
Ratio of heating surface in sq. ft. to cylinder volume in cu. ft.	351 to 1
Tractive weight in lbs. to heating surface in sq. ft.	43.82 to 1
Tractive weight to tractive effort	4.39 to 1

Tests of the Westinghouse Improved Quick-Service Triple Valves.

During the fifteen years that have elapsed since the quick-action automatic air-brake came into general use on freight trains, the average weight on drivers of locomotives has increased from 100,000 lbs. to 200,000 lbs. and their drawbar pull from 25,000 lbs. to 50,000 lbs. Within the same period the average freight car capacity has increased from 40,000 lbs. to 100,000 lbs., and while in 1888, 50 cars in a train was considered a maximum, now 80 cars is common and 100 cars is by no means rare. Reference to these figures is not needed to emphasize the statement that brake apparatus which met all requirements 15 or 20 years ago is now satisfactory only in inverse proportion to the increased demands made upon it. So far as draft gear is concerned the proposition is self-evident. The tests made by the Westinghouse Air-Brake Company with a special train on the tracks of the Lake Shore & Michigan Central at West Seneca, N. Y., August 23, 1905, served to demonstrate how much more adequate modern brake apparatus and friction draft gear is to withstand the severe service conditions of train operation today than the old apparatus which has for so long served its purpose well.

The train used in making the tests consisted of 50 steel underframe gondolas with wood bodies of the Baltimore & Ohio type, having a capacity of 100,000 lbs. and a light weight of 45,000 lbs. They were equipped with standard 10-in. freight cylinders having standard triple valves (H-49) and also improved quick-service triple valves (H-49-B) arranged with a cut-in and cut-out device for competitive tests. The other special Westinghouse devices included friction draft-gear, automatic air coupler, American automatic slack adjuster and high and low-pressure retaining valves.

The locomotive used was a consolidation (2-8-0) type, Pennsylvania class H6a; cylinders, 22 in. x 28 in.; diameter of drivers, 56 in.; boiler pressure, 205 lbs.; weight on drivers, 173,000 lbs.; tractive force about 40,000 lbs.; main-reservoir pressure, 90 lbs.; brake-pipe pressure, 70 lbs.; main-reservoir capacity, 66,000 cu. in. Engine equipped with the same special devices as the cars and also with the Westinghouse improved engine equipment, possessing the combined straight-air and automatic, together with the distributing valve features.

The new quick-service triple valve with which the cars were equipped is an improved form of the old standard quick-action triple valve designed to quicken the service application of the brakes on long trains so as to obtain such application on the rear cars of an 80 or 100-car train in approximately the same length of time as was formerly accomplished by the standard valve on a 20 or 30-car train. With the improved valve on long trains a 5-lb. reduction is equal in efficiency to a 20-lb. reduction in the train pipe pressure with the old type of valve, thereby making it possible to apply a greater number of brakes in the train with these valves than was possible with the old valves. With the new triple valve the quick-service application gives approximately an equal cylinder pressure on all cars regardless of the length of the train. Hence it enables making shorter stops and tends to decrease the number of slid wheels by avoiding the increased retardation produced by the excessive pressure produced in the cars at the head of the train when using the standard triple valves. In the new valve a retarding feature has been provided which puts the movement of the train much more fully under the control of the engineman, enabling him to release the brakes on the rear cars of a long train first if desired, thereby permitting the slack to run in and avoiding the jerking and lurching of the train from the rear which often results in break-in-twos. Or, if desired, on account of different road conditions, release can be made from the first car towards the rear, keeping the train stretched. If the conditions are favorable for simultaneous releasing, this can also be accomplished by proper manipulation of the engineer's valve. The necessary modifications in the new valve to accomplish these ends can be made to the present standard valve using the same triple-valve shell, casing and all connections.

The essential improvements in the engine equipment consist of an appliance that enables the engineman to more uniformly control the brakes on long trains and also provides a straight-air or automatic feature for the independent locomotive and tender-brake operation which works in unison with the automatic train brakes, if desired, or gives an independent, graduated straight-air action by a simple movement of the engineer's brake-valve. By the function of what is known as the distributing valve, the pressure in the cylinder of the locomotive and tender brake is automatically maintained. In other words, when once applied, with the new apparatus, the pressure is constant so long as pressure exists in the main reservoir and can only be released by the manipulation of the handle of the engineer's brake valve. By the use of the new apparatus, a more rapid recharging of the brake-pipe can be accomplished with either the new or old type of triple valve, lessening the time required for recharging the brakes.

NOTE.—In all tests the dynamometer car was the twenty-sixth in the train.

The following is a condensed log of the air-brake tests:

Test No. 1.

Standard (old style) triple valves. Speed, 20 miles per hour. Reduction, 20 lbs.
Brake-pipe reduction, 20 lbs.
Speed, 21½ miles per hour.
Length of stop, 557 ft. 9 in.
Length of stop reduced to 22 m. p. h., 584 ft. 0 in.
Duration of stop, 25 seconds.

NOTE.—Runs 1 and 2, covering Test 1, were not counted owing to the improper action of the equalizing piston in the brake valve.

Test No. 1-A.

Repeat Test No. 1, with 5-lb. reduction.
Brake-pipe reduction, 5 lbs.
Speed, 22¼ m. p. h.
Length of stop, 1,312 ft. 10 in. (See note.)
Length of stop reduced to 22 m. p. h., 1,283 ft. 6 in.
Duration of stop, 57 seconds.

NOTE.—In announcing the tests at the time they were made, it was announced that this was 1,613 ft. 10 in. The record given above is the correct one.

Test No. 2.

Quick-service (improved) triple valve. Speed, 20 miles per hour. (Same as Test No. 1.) Reduction, 5 lbs.
Brake-pipe reduction, 5½ lbs.
Speed, 22¼ m. p. h.
Length of stop, 456 ft. 2 in.
Length of stop reduced to 22 m. p. h., 446 ft.
Duration of stop, 20.2 seconds.

Purpose of Tests Nos. 1 and 2 is to show that practically the same length of stop is obtained with a 5-lb. reduction with new triple valves as with a 20-lb. reduction with old triples, thereby making it possible to operate positively a train with a much larger number of brakes in operation, when equipped with new valves, than can be done successfully with old-style valves, which fact has been demonstrated with 100-car train test—the brakes working throughout with new style valves.

Test No. 3.

Quick-service (improved) triples. Speed, 20 miles per hour. (Same as Test No. 1.) Reduction, 17 lbs. (equalization).
Brake-pipe reduction, 17 lbs.
Speed, 22 m. p. h.
Length of stop, 382 ft.
Length of stop reduced to 22 m. p. h., 382 ft.
Duration of stop, 16.4 seconds.

Note that equalization with the new triples requires only 17 lbs. reduction, while old triples require 20. Test No. 3, when compared with No. 1, will show lengths of stop obtainable by the two different types of triples when the brake cylinder and auxiliary pressures are equalized.

Test No. 4.

Standard (old style), triples. Speed, 20 miles per hour. Reduction, 10 lbs.
Brake-pipe reduction, 10 lbs.
Speed in m. p. h., 22¼.
Length of stop, 774 ft. 6 in.
Length of stop reduced to 22 m. p. h., 757 ft. 3 in.
Duration of stop, 33.6 seconds.

Test No. 5.

Triples arranged, 25 standard (old style), 25 quick-service (improved), alternating in groups of 5. Speed, 20 miles per hour. Reduction, 10 lbs.
Brake-pipe reduction, 10 lbs.
Speed, in m. p. h., 22¾.
Length of stop, 538 ft. 0 in.
Length of stop reduced to speed of 22 m. p. h., 503 ft.
Duration of stop, 23.2 seconds.

Tests Nos. 4 and 5 will show, (1) that both triples work in harmony, (2) that shorter stops are obtained practically in proportion to the number of new triple valves introduced.

Test No. 6.

Twenty-five standard (old style) triples ahead, and 25 quick-service (improved) triples behind. Speed, 20 miles per hour. Reduction, 20 lbs.
Brake-pipe reduction, 20 lbs.
Speed in m. p. h., 21¾.
Length of stop, 569 ft. 5 in.
Length of stop reduced to speed of 22 m. p. h., 491 ft. 0 in.
Duration of stop, 20 seconds.
The maximum drawbar tension during this test was, 18,000 lbs.

This test probably represents worst possible combination of old and new triples, proving that the jerk due to the latter being in the rear is but slight.

Test No. 7.

Standard (old style) triples. Speed, 30 miles per hour. Reduction, 20 lbs. Brakes released at slow speed and full head of steam at once applied to keep train in motion.
Maximum drawbar pull due to release and use of steam was 169,000 lbs.
This test resulted in breaking the knuckle on the rear of the nineteenth car.
Brake-pipe reduction, 20 lbs.
Speed in miles per hour, 30.9.
Release made at 12½ miles per hour.

Test No. 8.

Quick-service (improved) triples. Speed, 30 miles per hour. Reduction, 5 lbs. Brakes released at slow speed, as in Test No. 7.
Maximum drawbar pull due to release of the brakes and use of steam, 34,000 lbs.
No damage whatever resulted in the train.
Brake-pipe reduction, 5 lbs.
Speed, 31½ miles per hour.
Release made at 15 miles per hour.

The purpose of Tests Nos. 7 and 8 is to show that the releasing at slow speed, which causes so many break-in-twos with the standard apparatus, is practically rendered harmless with the improved type of triple valve. The retardation of train with a reduction of 5 lbs. is greater than obtained with a 20-lb. reduction using the standard valves. This is shown to be so by the Triple Valve Tests; see results of Tests 1 and 1a, also by accompanying curve.

With the improved triple valves, the action of valves in retarding the release will stall the train and prevent damage, even when

steam is used, if an attempt is made to release when the speed of the train is very low.

Test No. 9.

Standard (old style) triples. Speed, 30 miles per hour. Reduction, 10 lbs. Brakes released at slow speed and steam applied to keep train in motion.

Maximum drawbar pull, due to the release of the brakes and to the use of steam, 42,000 lbs.
Steam used 15 seconds after release.
Speed, 32 miles per hour.
Brake-pipe reduction, 10 lbs.
Train was kept in motion by use of steam.
Brakes released at 15½ miles per hour.
Minimum speed, 6½ miles per hour.

Test No. 10.

Test No. 9 was repeated with quick-service (improved) triples.

The maximum drawbar pull, due to the release of the brakes and to the use of steam, 45,000 lbs.
Steam used 7 seconds after release.
Speed in miles per hour, 33.
Brake-pipe reduction, 10 lbs.
Brakes released at 16.1 miles per hour.
Minimum speed, 4 miles per hour.
Train kept in motion by use of steam.

The 20-lb. reduction with the old and the 5-lbs. with the new valves was made to see the comparative results that would be obtained with reductions that would give, as nearly as possible, the same comparative stop. The 10-lb. reduction shows the greatest reduction that could be made with the new valves, with this train, and at a speed of no faster than 33 miles per hour, followed by a release at a speed as low as 10 m.p.h. With a heavier reduction the train would have been brought to rest before it could have been possible to have accomplished a release.

Purpose of Tests Nos. 9 and 10 same as that of Nos. 7 and 8: To show effect produced by making a release and using steam at slow speed; also to demonstrate, with equal reductions, a much shorter stop than can be made with new valves.

Owing to greater retardation, release with improved valves must be at higher speeds than with old valves to keep train in motion. See Tests 9 and 10.

How to Define Cost.*

This committee has compiled a large amount of data, which in a large measure deals with the question of accounting. The committee is of the opinion that the Association should not attempt to establish or even outline an accounting system to cover the charges incidental to the expense of signaling, but submits the following data as a basis for making charges for the construction, operation and maintenance of interlocking plants:

Construction:

All materials required to make installation complete in every detail.
All labor.
Freight.
Train service.
Expense of making plans and specifications.
First equipment of all utensils and supplies.
Tower building.
Oil and supply building.
Power house.
All machinery and equipment necessary on account of use of power system.
Expense of building permits or other permits issued by public authorities.
Expense of inspection by State authorities.
Supervision.

Operation:

All wages paid levermen.
All wages paid lampmen.
All wages paid train directors.
All wages paid engineers or firemen.
Fuel.
Oil.
Waste and all other supplies used for the operation of plant.
Expense of power or light bought from outside concerns.
Expense of telephone service or other means of communication required for operation of plant.
Stationery used on plant.
Water service.
Fire alarm service or other protection against fire.
Freight on supplies.
10 per cent. on supplies to cover cost of handling.

Maintenance:

All labor used in keeping plant in a proper state of repair.
All material used to replace worn out or broken parts (not including materials or labor required to repair damage occasioned by derailments or kindred causes).
All tools needed by regular workmen employed on plant.
Fuel and light needed by maintenance force.
10 per cent. for maintenance labor to cover cost of supervision.

The committee has not made any allowance for interest on the investment, taxes, depreciation or other fixed charges, as each company, of necessity, will take care of these matters in accordance with the records of the accounting departments. The committee, however, is of the opinion that the depreciation is equivalent to 5 per cent. per annum. This is on the basis of first-class construction. Where less permanent standards are followed it frequently happens that the depreciation will amount to over 10 per cent. or 15 per cent. per annum.

During the past year a considerable amount of discussion has taken place in regard to what shall constitute proper charges at interlocking plants owned jointly by two or more railroads. A great many railroads have agreed to accept bills on the basis of 10 per cent., to be added to the cost of materials and maintenance labor, to cover the expense of supervision, this arrangement being effected by the General Managers' Association [of Chicago].

*Report of Committee No. 6, Charles Dunham, chairman, presented to the Railway Signal Association at its annual meeting at Niagara Falls, October 10-12.

A Study of American Locomotives.*

BY M. E. OUDET.

A mistake which is frequently made in endeavoring to explain the low price at which the American manufacturers build locomotives is to conclude that the engines are built by the hundred from designs which are absolutely invariable. Nothing could be farther from the truth. The largest order ever received by the Baldwin Locomotive Works for locomotives to be built from the same design did not cover more than 80 engines, and an examination of the catalogues of the Baldwin, Schenectady and Pittsburg locomotive works will show a very large variety of types. During the past ten years the American railroads have been continually increasing the power of their engines, and in point of view of dimensions a single railroad will have as many varieties as are to be found in France. A still greater distance separates the Americans from the uniformity of types and parts found on some of the English roads, such as the London & North-Western and the Lancashire & Yorkshire.

The American locomotive builders have, however, an advantage still greater than the adoption of invariable types and dimensions, and that is the uniformity of the general design of the locomotives and the simplicity of design of the various parts.

An American locomotive may have two pairs of driving wheels 78 in. in diameter with a four-wheel front truck, or it may be a consolidation with four pairs of driving wheels 56 in. in diameter and a two-wheel truck. However the arrangement may vary, the general design remains the same, and in all cases the cylinders are placed in the front and serve as a support for the boiler. They are also always of the same general design unless the engine is a four-cylinder compound or has piston valves. The number of frame crossties will vary, but the crossties are always of the same two types; ribbed cast-iron or steel plates in front of the cylinders and at the back of the engine, and bar-iron ties to maintain the proper spacing of the frames. The valve motion is always placed between the frames, and it, as well as the reverse lever, is always of the same type. The throttle is always of the balanced poppet type, and the steam pipes are always placed inside the smoke-box and connected to the cylinders in the same manner. The boilers may vary considerably in form, but the same uniformity of design is to be found in numerous details. In regard to the simplicity of design of the parts, there is no exaggeration in saying that the valve motion of any American machine costs only half as much as that of a Continental locomotive with outside cylinders. The cost of the running boards is one-quarter that of ours. The truck frame with its boxes and spring rigging can be built at a very much lower cost than the similar parts of our engines.

It would be easy to multiply examples, but the main fact is already clear The high power of their tools and the large amount of work done by the American machinist are important factors in the rapid and economical construction of the American locomotives, but a very considerable part is also played by the simplicity of design both of the locomotive as a whole and of its various details.

The American locomotive builders derive great benefit from this general uniformity of design. A few patterns of eccentrics and eccentric straps, of reverse shafts, of boxes, and three or four trucks of various sizes serve for the construction of a large number of locomotives which differ from each other in the number of wheels and in general dimensions.

In this connection I quote a single instance. During my visit to the Canadian Pacific shops at Montreal the engineer, Mr. Atkinson, called my attention to the fact that the drawings of a Vauclain compound which had been tested on July 4th had been commenced on May 1st. In the drafting room in these shops there are three designers. This extremely rapid construction and design could not have been equaled in France, where, on account of the designs and general arrangements which are used, it would be necessary to go over the entire design, from the cylinder pattern to the arrangement of the brake rigging and ash pan.

It is easy to see the reasons which have led the American builders to this uniformity of design and which have led away from it in Europe. In the first place stands the wide experience acquired by such works as Baldwins, Schenectady, Brooks, which are constantly in touch with their clients both in the production of new designs and in following up the service of the locomotives they build. In the hands of the managers of these establishments the locomotive undergoes a species of evolution, and becomes the product of a natural selection which only perpetuates those arrangements and designs which experience has shown to be best.

The American engineer is at the same time a merchant who is on the lookout for the article which sells best and who discards all useless complications and everything which does not pay. In

*Translated from the *Revue Mecanique*, February, 1902.

Europe, on the other hand, the locomotive has been developed by engineers who are often more occupied in developing their personal ideas than in looking around them to find those arrangements which have been shown by experience to be best and simplest.

The poor condition of much of the American track, particularly in the early days, led to the adoption of two arrangements: The truck to facilitate the passage of sharp curves, and the equalization of the springs to enable the engine to adapt itself to the inequalities of a badly ballasted track. The bar frame appears to have come originally from England and has been retained on account of the desirable simplicity attainable by its use.

The reasons which have led to the adoption of the simplicity so often referred to are equally easily recognized. In the first place the competition between the builders leads them to avoid any part which is complicated and therefore expensive. Then the proximity of the drawing room to the shop which forces the draftsman, who has himself often worked in the shops, to take into consideration the difficulty of constructing any piece and the part it is to play in the locomotive. Consequently the form of a part is chosen not merely so as to join conveniently two arcs of a circle, and the question of what shape a part is to have is not separated from the question of how it is to be made. Then the scarcity and inferiority of the hand work, especially of forge work, makes it necessary to avoid all complicated forgings and to use as far as possible rolled shapes.

Further, it must be acknowledged that the design of the American locomotive shows in many places a more just idea of the role which the parts have to play in the locomotive, both as regards the general design and as regards manufacture. For example, the purpose of the running board is to give easy access to the safety valves, whistle, and sand box, and to enable a man to get around the locomotive. The Americans take this view and build it as they would a platform in a shop. A series of brackets carry boards or a sheet iron plate. Although meant for the same purpose on the European locomotives, it often fails to fill it, for the designer places it where it will best please the eye. The running board is fused with the rest of the locomotive; it is supported on the guide yoke, is depressed at the front, and in the end is a very expensive construction.

The same thing holds for the cab. The American thinks of it as a shelter for the crew, and will put the same cab on a dozen different engines, while in Europe the cab design is swayed by the same considerations as hold for the running boards. On the European locomotive the fact that the parts are intended for a locomotive causes them all to be treated as regards design and finish as parts of a steam engine, while the parts of an American locomotive are treated appropriately to their service.

Terminal Improvements of the New York Central & Hudson River in New York.*

It has been said by an eminent engineer of the old school that no railroad should erect other than temporary structures, as permanency in design retards progress. This would seem to be wise economic counsel, but on the contrary the sound policy of modern railroad management causes to be spent each year enormous sums in rebuilding structures, which at their inception were the best that could be built, but have become inadequate. The population of a municipality increases gradually. Improvements must be made periodically, and it is only a question of time when they become "out of date."

In 1860 the New York & Harlem passenger station was located at the corner of Fourth avenue and Twenty-seventh street, on the present site of the Madison Square Garden. In 1871 the first train left the Grand Central Station, newly completed. In 1899 the Grand Central Station was rebuilt. Thus in the comparatively short period of 45 years three terminals have been built, and now again the facilities are "out of date."

For several years prior to 1903 serious consideration had been given to the adoption of electricity to replace the steam locomotive as a means of motive power through Park avenue tunnel, and in July, 1903, the Legislature passed an enactment authorizing the New York Central to enter into an agreement with the City of New York relative to the enlargement and depression of the Grand Central yard. The same act called for the completion of the change of motive power, south of the Harlem river through the Park avenue tunnel, in five years after the passage of the law.

After further careful consideration of the subject, the railroad company deemed it inadvisable to change from steam to electric operation just north of the Harlem river, about five miles from the Grand Central Station, as required by law, and for many reasons decided to extend the zone of electric operation to the limits of the immediate suburban territory. The terminals will be located at a point just south of Croton on the Hudson division, 34 miles from Grand Central Station, and at North White Plains on the Harlem division, 24 miles from Grand Central Station.

In considering the change of power from steam to electricity over this considerable territory of some 58 miles of main line, two classes of improvements were considered; those closely involved with the change of power and made necessary thereby, and those which might consistently be carried on at the same time for the convenience of the public and for increasing and improving the traffic facilities of the railroad, but which were in no way made necessary by the adoption of electric power. Many of the improvements proposed, in the way of eliminating grade crossings outside the limits of the city, depend on the concerted action of the state and municipal authorities for the carrying out of the work under the elimination law of 1897. With this support promised, however, the railroad company is prepared to carry out improvements throughout the entire zone of electrification which will amount to the practical rebuilding of the road within these limits.

Excavation of First Section of New Grand Central Yard.

The extent of these improvements, for which plans have already largely been perfected, are in outline briefly as follows:

1. The depression and enlargement of the main tracks and yard of the terminal proper from Forty-second street to Fifty-seventh street.
2. The erection of a new Grand Central Station on the site of the present structure.
3. The construction of the "Marble Hill cut-off" and the "Spuyten Duyvil rectification" near Kings Bridge.
4. The depression of the Port Morris branch with the elimination of all the grade crossings thereon.
5. The elimination of all grade crossings and making of special station improvements within the zone of electrification.
6. The four-tracking of the Hudson and Harlem divisions.
7. The electrification of all lines within the limits of the proposed improvements.

ENLARGEMENT AND DEPRESSION OF THE GRAND CENTRAL YARD.

The plans finally adopted as mutually advantageous to the City of New York and to the railroad company and its patrons.

*By G. R. Wadsworth, late with the New York Central.

Birdseye View of the Present Grand Central Yard.

Excavation in Park Avenue, Looking North.

and those on which the work is now progressing, were approved by the Board of Estimate and Apportionment of New York City in July, 1903. A revised set of plans, calling for some minor changes, but in the main similar to the original set, was submitted to the board in December, 1904, and have recently been approved.

All cross streets between Forty-fifth street and Fifty-sixth street inclusive will be restored. From Fiftieth street north the streets will cross the tracks substantially at the present grade of Park avenue, and south of Fiftieth street, grades not exceeding 4 per cent. will be employed. These cross streets will be intersected by Park avenue as it will be extended for its full width of 140 ft. from Forty-ninth street to Forty-fifth street. Thus about 4,500 ft. of city streets will be restored to normal public use, connecting the residential sections east and west of Park avenue, augmenting fire protection and giving a general appreciative tendency to all real estate in the neighborhood. The streets will be carried over the tracks on steel viaducts, with concrete steel floors, and asphalt street and sidewalk paving. The viaducts will be provided with heavily ornate railings and with electroliers at corners and at suitable intervals between.

The street bridging is of the deck type except where the requirements of column spacing forced the adoption of through girders or trusses, as in Park avenue between Fifty-sixth and Fifty-seventh streets, where the steel work will be cased in concrete of an ornamental design to harmonize closely in architectural features with the surrounding residences. Provision has been made to carry water and gas pipes and electric duct lines through the floors of the new viaducts. All of the streets will be restored between Madison and Lexington avenues from Forty-fifth to Fifty-sixth streets, the railroad company retaining for its use merely the sub-surface rights in the streets.

To carry out this plan of street restoration, which is an important feature of the improvement in benefits accruing directly to the city, necessitated the depression of the present main and yard tracks which south of Fiftieth street are practically on a grade with Lexington avenue. The track depression begins at Fifty-seventh street, at the foot of the grade from Park avenue tunnel to the present yard, and extends to Forty-second street, for the full width of the new yard, the present grade being lowered from 15 to 20 ft. Underneath this new main yard, in a further depression of about 21 ft. extending from Forty-third to Fifty-third streets, is located the new suburban station and yard. From Forty-third street the suburban yard will extend for the full width of about 300 ft. between Vanderbilt avenue and Depew place, north to Forty-ninth street, where the yard will begin to converge to meet the established width of Park avenue at Fiftieth street. This depression of the present track grades between Forty-second and Fifty-seventh streets forms a complete barrier to the natural drainage system of the section and consequent changes to the existing sewers, as well as new sewers to drain the depression were necessary. The existing sewers were intercepted in Madison avenue south of Fiftieth street and carried around through Forty-second street. North of Fiftieth street, sewers were intercepted in West Park avenue and led into the main trunk sewer in Fifty-fourth street which was depressed to meet the requirements of the new track grade. A new Second avenue to provide for draining the depressed yard. To drain the lower levels without the use of pumps a 6-ft. private sewer is to be built to empty into the East river. This will pass under all existing sub-surface structures now in the ground. Changes of a similar nature were necessary in gas and water pipes, temporary lines being put in service in many instances until the permanent lines could be laid in new locations, across the street bridges. Changes in sewers, water and gas pipes have already been largely completed. Pipe galleries will be provided in the walls of the depressions, for the disposition of the necessary pipe lines for railroad uses, and incorporated in the walls are also the ducts for the electric power transmission cables.

Bridging in Park Avenue at 56th Street.

The enlarged yard provides for the occupation of Park avenue for its full width of 140 ft. between building lines south of Fifty-sixth street to the northerly limits of the yard proper at Fiftieth street. The existing four main tracks through the tunnel will diverge from Fifty-seventh street to ten tracks at Fifty-sixth street, the six center tracks leading to the upper yard, and two tracks on either side beginning at Fifty-third street, descending at grades slightly in excess of 2 per cent. to the level of the suburban yard at Fiftieth street. Between Fiftieth and Fifty-seventh streets the street surface of Park avenue will be restored to conditions similar to those north of Fifty-seventh street, there being a driveway on either side with openings over the tracks between the driveways. South of Fiftieth street the plan of the new yard covers an area of about 13 city blocks between Madison and Lexington avenues north of Forty-second street, an increase of six blocks over present conditions.

One of the foremost requirements in the design of the new terminal was the adaptation of the yard for the complete handling of terminal traffic. Under existing conditions, on account of the limited space of the present yard, all through trains and periodically local trains have to be hauled north through the tunnel about five miles to Mott Haven yard, for turning, cleaning, restocking, minor repairs, etc. At Mott Haven cars have to be switched into the proper order for outbound trains and again brought through the tunnel to the Grand Central Station, thus making ten miles of light mileagle. Under new conditions all these operations will be done at the Grand Central yard.

Ample provision will be made for storing and cleaning all classes of equipment, each assigned to its own group of tracks, so

Excavation in Park Avenue, Looking South.

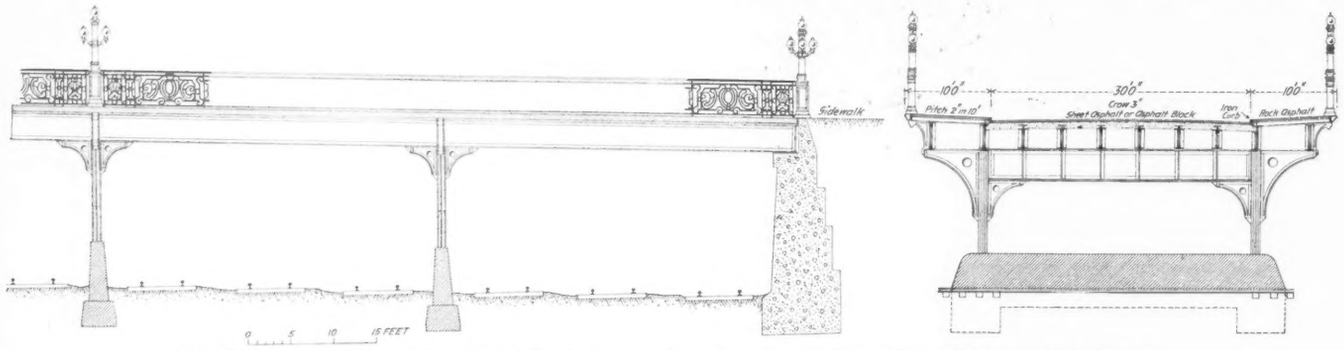
as to be readily available for the proper making up of trains in the classified order. Eighty-foot turntables are provided for the turning of private and observation cars, mail and express cars. Separate tracks are provided for the American and Adams Express Companies, as well as for the United States mail service, and special provisions in the way of elevators are made for the quick and easy transfer of express and mail matter from wagons or from cars of the New York City Railway Company to the express and mail platforms.

The yard will be equipped throughout with steam, air, Pintsch gas and water, with cocks at convenient intervals. Ample provision for the artificial lighting of the yard by electricity will be made, for although the greater part of the yard will be open, it is the plan of the railroad company to hold the air rights of the yard property abutting on the streets available for rental purposes for office or public buildings. To this end the yard tracks are so laid out that frequent column spacing for building supports is possible in the future.

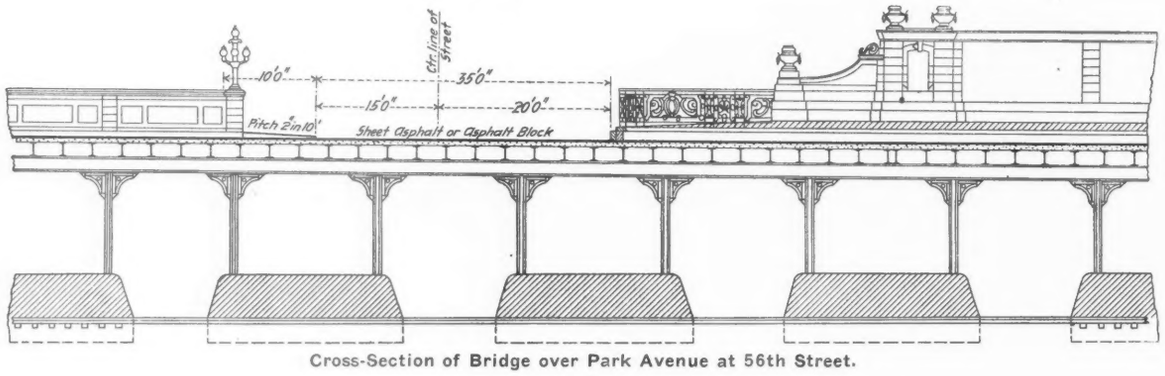
for loading and unloading. The through platform tracks are separated into two groups. Each group has a loop track at the south end, and under normal conditions, with right-hand operation, trains for the easterly pocket will pass round the loop before discharging, while trains for the westerly pocket will discharge and load before passing round the loop.

Double-end storage pockets are also provided on either side, north of the platforms, with clearances for maximum equipment, as well as a stub pocket between the running tracks extending north to Fifty-second street. As the ladder-tracks from the north end of the two side storage pockets cut the main running tracks leading from the upper level to the suburban yard near the foot of the incline, these pockets will be easily available for the storage of through equipments from the upper yard.

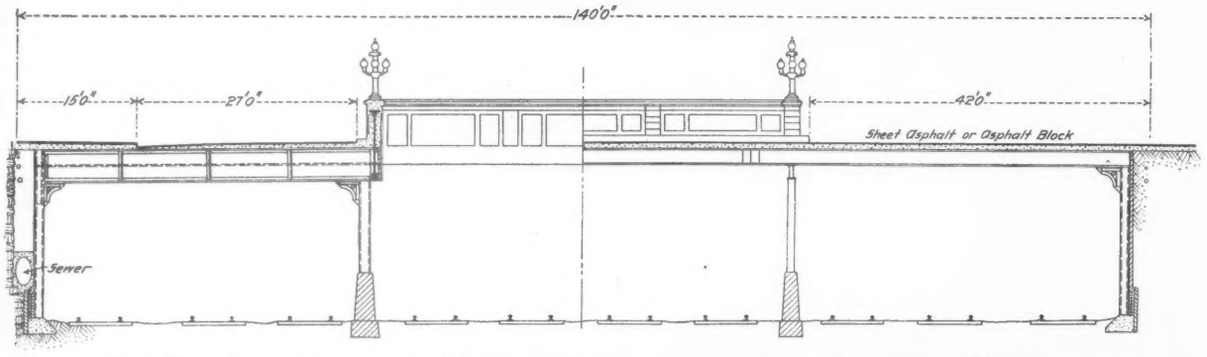
The suburban yard, except the double track loop, as well as the through yard is designed on standard New York Central clearances to accommodate maximum equipment. Some consideration was given to the advisability of adopting for the new electrically



Side Elevation and Cross-Section of Bridges over Park Avenue at 46th, 47th, 48th and 49th Streets.



Cross-Section of Bridge over Park Avenue at 56th Street.



Part Elevation and Longitudinal Section of Bridges over Park Avenue from 50th to 55th Streets.

All main track switches and signals will be operated by compressed air or electricity. The main track switches and controlling signals in the upper level or express train yard will be operated from one central tower. The suburban station will have its own tower for the complete control of all switches and signals on that level. Switches and signals will be interlocked with the towers, and the separate towers with each other so as to control a complete train movement.

The salient features of the design of the new terminal is the complete separation of the through and the suburban traffic. The suburban yard is complete in itself, with platform and storage tracks, switching leads, etc. The design of the suburban yard tracks, it is believed, will prove peculiarly efficient for the uninterrupted handling of trains on one minute headway, allowing two minutes

operated suburban equipment, a type of car similar to the new subway cars, with a view to the interchange of equipment at the Grand Central Station. The connection planned between the loop track in the suburban station and the subway tracks in Park avenue would permit trains from suburban points along the road to continue via the subway to points below Grand Central Station to the Battery and Brooklyn. This operating feature was considered inadvisable, however, on account of the rather different classes of service the two companies have to perform, the subway car not being as well adapted to the comfort of passengers for the longer trip of upwards of 30 miles to the suburban terminal, as the somewhat larger New York Central suburban car which is too large for subway clearances. This connection will, however, greatly facilitate the handling of express and mail matter from points in lower Man-

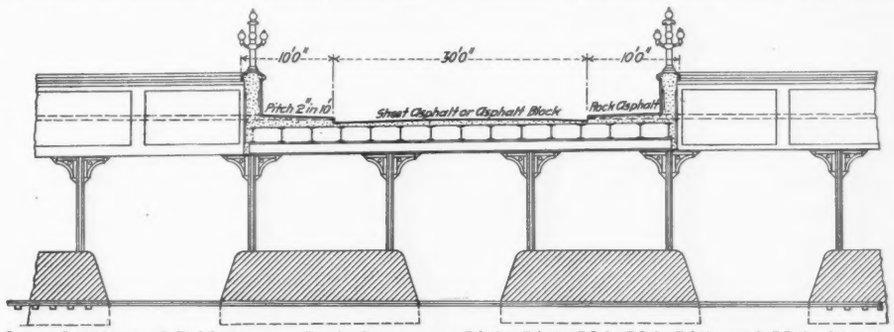
hattan via the Subway to the suburban station, whence it can quickly be transferred to through express trains, and vice versa.

The one feature of paramount importance in connection with the rebuilding of the Grand Central Terminal is the uninterrupted maintenance of the existing enormous traffic, which is increasing at the rate of between 5 and 10 per cent. annually. The work was laid out at its conception with this end in view, that the upwards of 1,000 regular daily train movements might be carried out on schedule, with safety and despatch.

The work is to be completed in sections, the first section to be completed and put in operation before the second is started. The first section now nearing completion includes parts of Park avenue and the six blocks on the west side of Lexington avenue between Forty-fourth and Fiftieth streets. Not the least important feature in connection with the work is the provision of temporary facilities for the convenience of passengers, and to meet operating requirements. Numerous changes of a temporary nature in the existing yard facilities were necessary at the beginning of the work.

It is the purpose of the company to utilize the lower floor of the Grand Central Palace for a waiting room to be used in connection with the operation of the first section. This floor is now given up to Station H of the New York post office. To provide temporary facilities for the post office, the company is erecting on the block between Madison and Vanderbilt avenues, Forty-third and Forty-fourth streets, a three-story temporary building, the lower floor of which will be used for post office requirements, and the upper floors for temporary offices of the company. This arrangement will prevail during the operation of the completed first section along Lexington avenue.

The north half of the new post office building, which is to occupy the two blocks between Lexington avenue and Depew place from Forty-third to Forty-fifth streets, will be built during the operation of section one, and upon completion of this half the post office will again be transferred from the temporary building on Madison avenue to its new home. The waiting room, up to this time on the lower floor of the Grand Central Palace, will then be moved to the temporary building on Madison avenue, to the lower floor formerly occupied by the post office, and the Palace will then be torn down and the remaining or south half of the new post office completed. The upper floors of the new post office building will then be temporarily available for all the offices of the railroad company, which will remove from the present Grand Central Station, leaving this structure vacant for removal and the beginning of the new station.



Cross-Sections of Bridges over Park Avenue at 50th, 51st, 52d, 53d, 54th and 55th Streets.

In connection with these temporary changes suitable passageways between the waiting room and the train platforms will be provided for the convenience of the passengers. Baggage and carriage facilities are also arranged, so that the business of a great railroad may be carried on uninterruptedly. The entire problem is one of particular nicety in engineering requirements, and is, in fact, the building of a terminal under a terminal.

The grading and masonry for the depression and enlargement of the main tracks and yard is being carried out by the O'Rourke Engineering & Construction Company, of New York City. The American Bridge Company, of New York, and the McClintic-Marshall Construction Company, of Pittsburg, are the contractors for the manufacture and delivery of the structural steel.

Use of Oil Fuel in Russia.

How serious for Russia is the interruption of the supply of petroleum from the Baku wells by the recent fires and riots may be judged from the fact that in 1902 (the last year reported) more than one-third of the fuel for all the locomotives of Russia came from these wells, and all that for the steamboats on the Caspian and the Volga, and a considerable part of that of the Russian steamers on the Black Sea. In 1902, out of a total of 14,326 locomotives in Russia, 5,181 used petroleum as fuel. Aside from the difficulty of obtaining all at once coal or wood enough to replace this oil, there is the further difficulty of using it in fireboxes fitted only for burning oil. And this difficulty comes just at the time when the moving of grain to market makes the greatest demand on all transportation facilities—greater than ever this year, because a large amount of last year's crop is still at the stations waiting to be forwarded. The relative value of petroleum and the different kinds of coal is calculated yearly. In 1902, 1 lb. of petroleum was reported to be equal to 1.44 lbs. of Welsh coal, and to 1.57 lbs. of the Donez coal most used in Russia. The other Russian coals are inferior. The coals used on the Siberian Railroad were especially so, 1 lb. of petroleum having the value of 1.95 lbs. of Ural coal, and of 4.17 lbs. of Ussuri coal, mined near Vladivostok.

Storage Batteries in Signal Work.*

The storage battery will stand more abuse and recover more rapidly than any other source of power; but the electrolyte must be kept at its proper density and free from impurities and short circuits. Most impurities come from the water. Iron, chloride, and other things, injure the plates. As the presence of these often escapes notice for a long time, the water should always be distilled and the electrolytes should be regularly analyzed.

For storage batteries at interlockings one of the most difficult things to determine is when the battery requires charging. A storage battery, when worked as required by an interlocking plant, can be discharged much lower than if the discharge was continuous, and for that reason it is not easy to tell when the battery is discharged to a safe point. The only sure way is to have an adjustable resistance so connected that the maintainer can discharge the battery at its normal rate for a period of five minutes and note when voltage drops to a pre-determined point. In order to have this limit high enough to allow for a slight variation I would limit the voltage to which the battery would be allowed to drop at the end of the five minute discharge to 100 volts; but in some cases this limit might have to be higher to insure the proper working of the plant.

One of the chief troubles is sulphating of the positive plates. Sulphating may be caused by allowing the battery to stand when over discharged, by electrolyte being too strong or too hot, or by short circuits between plates. I have been unable to learn the cost of a battery for interlockers because they have not been in service long enough to determine the average life; and there is but little information concerning storage batteries used for automatic signals.

On automatic installations there is a great difference in the duties of the different sets of cells, which, taken together, may be considered as forming one battery when being charged, and as divided into from 10 to 20 separate batteries when discharging. For instance, there may be batteries operating signals near yards which are on the same charging circuit with batteries which operate signals on the main line where no switching is done. It is evident that the battery in the first case may do many times as much work as the other batteries in the same charging circuit. There may be cases where four tracks run into two so arranged that the batteries supplying power for the four-track signals may have to be on the same charging circuit with those supplying power for the two track signals. In such a case, if the batteries on the two-track signals are being too heavily overcharged, either the batteries for the two-track signals must be cut out every other charge, or two sets of batteries be supplied for the four track signals.

Where a signal system is so laid out that there are both single and double locations the question arises will the batteries at the single location stand without injury twice as much charge as they are discharged.

These questions are yet to be fully answered for it requires a number of years to determine the life of a storage battery. On track circuits a constant current through the relay coils is desired and there can be no doubt that the storage battery with its almost constant voltage will give this current satisfactorily unless track conditions are exceptionally bad.

Railway Signal Association.

The ninth annual meeting of this association was held at Niagara Falls, N. Y., last week, beginning on Tuesday, President J. C. Mock in the chair. This association now has 532 members, 82 members having been admitted at this meeting, and 215 members were present, though not all of them remained throughout the six sessions. There were present 40 or 50 persons interested in signaling but not members of the association. Most of the sessions were well attended, making this the largest and one of the most important conventions ever held by the association. President Mock, in his opening address, spoke of the constantly increasing importance

*Abstract of a paper read by Edward L. Adams, Chief Signal Inspector of the Lake Shore & Michigan Southern, presented at the annual meeting of the Railway Signal Association, at Niagara Falls, Oct. 10-12.

of the association and of the vital problems in railroading connected with the signal engineer's work, which must be settled in the near future; and the settlement of which rests as a duty on this association.

The association voted to authorize the publication of a volume of about 500 pages containing the abridged proceedings of the association from its organization.

The first discussion was that on the report of Committee No. 6, which had been instructed to report on the classification of items for calculating the cost of construction, operation and maintenance. The substance of this report is printed in another column. The association voted to expunge the fifth item under the head of construction—expense of making plans and specifications—holding that this properly should be charged to the general expenses of the signal engineer's office. The last item under the head of construction—supervision—was changed to read "special supervision," the prevailing opinion being that most supervision should be a general expense. Under operation the fourth item was made to read "all wages paid engineers or firemen of power plants," and the next one was made to read "fuel and light." Under maintenance the last item was changed to read "10 per cent. to be added to the cost of labor for use of tools and supervision and handling; and 10 per cent. to cost of materials, for inspection and accounting." The following new item was added: Cost to the signal department of work done within interlocking limits in consequence of laying new rails and reballasting track.

In the discussion of this report it was stated that two large roads west of Chicago have agreed not to make charges to each other for damage to interlocking by derailments at crossings and junctions unless the amount is $100 or over, experience having shown that the cost of investigating and deciding who is at fault often turns out to be greater than the amount of damage.

Committee No. 2; Circuits for Manual Block Signals. The committee on this subject, of which Mr. C. H. Morrison (Erie) is Chairman, made a report which is in the nature of a supplement to one made last year. It consists mainly of a brief history of manual block signaling, references to descriptions of lock and block apparatus, and descriptions, consisting of one or two paragraphs each, of the telegraph block system, the staff system and the controlled manual. The committee closes with a brief statement of requisites of installation and adjuncts. Locks by which control of the signal may be had by the operator at each end of the block are set down as adjuncts to the telegraph block system; and the use of track circuits the full length of the block is classed as an adjunct to the controlled manual system. With the staff system a home signal, interlocked with the staff machine, is one of the requisites, and the adjuncts are: (1) Permissive attachments; (2) staff catcher for locomotive; (3) cranes for holding and receiving staff; (4) divided staffs; (5) pusher staff. Electric locks on all switches in main track that are not interlocked are classed as adjuncts to all manual controlled systems. The committee recommends that manual block signals be always controlled, the extent of this control to be arranged according to the conditions.

This recommendation, after some desultory discussion, was approved. Nothing less vague than this would have been accepted, as there was a strong sentiment that "control" does not mean much unless the signals have all the approved locking and safety devices, including a track circuit the whole length of the block section.

After this the meeting spent several hours in discussing the report of Committee No. 8—that on Standard specifications for mechanical interlocking. That part of the report under discussion consisted of paragraphs 60 to 130; but no useful result was accomplished. Many members expressed their individual views, but this developed marked differences on many points, and the assemblage was too large to properly handle such a matter. A number of paragraphs were referred back to the committee, so that the final revision of the report will vary in many paragraphs from that which was printed previous to the meeting.

This committee submitted a diagram (to be used in place of the table which was printed on page 70 of last year's Proceedings) for use in determining the differences in the lengths of rods, cranks and compensators to provide for differences in temperatures. This diagram is accompanied by a list of the districts into which the United States Weather Bureau has divided the country, and the "normal" temperature of each district is given. The diagram has four temperatures as bases; namely, 40 deg., 50 deg., 60 deg. and 70 deg. For example, at Duluth 40 is to be used as the base in making calculations; at Columbus, Ohio, 50; at Nashville, Tenn., 60, and at New Orleans 70.

On Wednesday morning the meeting took up the report of Committee No. 5, A. G. Shaver (U. P.), Chairman, that on Organization of the signal department. The main conclusions of this report are given in the next six paragraphs.

The Signal Engineer, or other Chief Signal Officer, everywhere has charge of signal construction; on 17 roads (replying to the committee's inquiry) he has charge of construction and maintenance; but on only six roads has he direct supervision over construction, maintenance and operation.

On 15 roads the signal department is apparently a departmental organization, at least in so far as construction and maintenance are concerned, while on the remaining 13 roads the organization is evidently purely divisional. Of late years the tendency on many roads has been toward a divisional rather than a departmental organization. Some roads, recognizing the importance of signaling, have retained the departmental organization for that branch of the service, although they have changed to the divisional organization in every other respect. Others have made the change to the divisional organization complete, giving the chief signal officer supervision over construction but either nominal or no powers over maintenance and operation.

As to the efficiency of the two organizations, it would be interesting to compare, if it were permissible, the signaling on two roads, one where the chief signal officer has entire supervision over construction, maintenance and operation and the other where he has charge of construction, but only nominal supervision over maintenance and operation. It would undoubtedly be found, if the signaling was as efficient with one as with the other, that it was costing considerably more on the latter road.

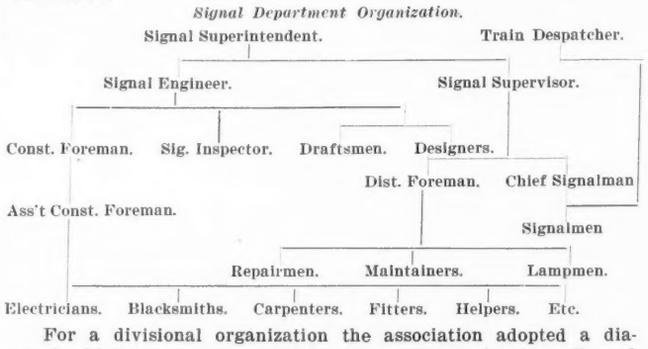
As railroad signaling is highly specialized and in a process of continual development, it is absolutely necessary that the signal officer keep closely in touch with it in all its phases in order that the construction, maintenance and operation be effective and efficient. The highest degree of efficiency can only be obtained when the chief signal officer has full charge, or authority approximating such, over all signal matters. He should come into actual contact with maintenance and operation in order to be thoroughly familiar with them and to act intelligently in construction matters.

Money is saved and good results obtained when the chief signal officer can use men from the maintenance force on construction; when he can educate men on construction work for maintenance and operation; when he can transfer men from one division to better positions on another; when he can use surplus or second-hand materials of one division to advantage on another; and when he can make one division profit by the experiences of another.

If changes in force are necessary, if service tests of apparatus are to be made, if dangerous conditions arise, if inspections show that matters need attention, the chief signal officer should not be required to get action through his superiors, who are busy men and should give their attention to other matters. If the chief signal officer is not capable of taking care of such matters then the company would do better to dispense with his services.

The association adopted as suitable for a road with a departmental organization the following diagram recommended by the committee:

Signal Department Organization.



For a divisional organization the association adopted a diagram* which was recommended by the committee for a small road after adding to it one line, from "signal supervisors" upward to the officer in charge of maintenance on the division, the intention being to have the supervisors report on construction and standards to the signal superintendent and to the division officer on maintenance and operation. These things having been decided, the report of the committee was adopted.†

In the discussion, a number of speakers strongly advocated

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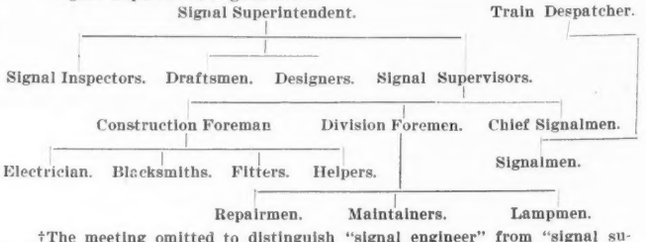
*Signal Department Organization.



†The meeting omitted to distinguish "signal engineer" from "signal superintendent," apparently by inadvertence.—Editor.

the departmental organization for signal work, and their exchanges of experiences showed that this opinion had largely arisen because of difficulty in getting division superintendents to adhere to correct signaling methods. Apparently a large number of division superintendents in the west still need much education in signaling. ("Why confine this statement to the west?" remarked a prominent eastern member.)

Committee No. 1, L. R. Clausen, Chairman, presented a report on "Circuits for Automatic Block Signals, for Steam and Electric roads." This report consisted chiefly of specifications and requisites of installation for track circuits, classified under the following heads: Relays, relay shelter; batteries; bonding and insulation; track insulation; battery shelter; insulated wire connections; track connections and trunking. The substance of this report will be given in a future issue. The report was subject to considerable criticism, for the committee had refrained from giving its own views, but had aimed merely to give on each point the view supported by the majority of the answers received in reply to a circular. About 100 circulars were sent out and 23 replies were received, of which four gave no information.

That part of the report relating to relays was recommitted because of the declaration of manufacturers that it was impracticable to make a satisfactory relay to close at .06 ampere and release at .04 ampere.

The discussion of this report disclosed that the disturbance of track circuits by foreign currents is still an important question in many places. At one point on a road west of Chicago, where there had been much trouble, the construction of a cable return by the trolley railroad had cured the trouble. The question was asked whether injunctions could not be secured from the courts to prevent interference, but it was said that the telephone companies which had sued electric light and power companies had uniformly lost their suits. The association finally ordered the appointment of a committee to investigate this question, and President Mock appointed as this committee the following members, the first five of whom are the ones who had made the report just discussed: L. R. Clausen, Chairman; E. A. Everett, C. H. Dryden, H. J. Hovey, C. A. Parker, C. C. Anthony, W. H. Elliott, Azel Ames, Jr., C. C. Rosenberg.

Committee No. 13, Azel Ames, Jr., Chairman, made a report on rubber covered wire, which will be found in another column. Mr. Everett Morss, President of the Simplex Electric Co., who said that he voiced the views of his own and three other companies, declared that it was impossible to make insulation to the specifications laid down in the report without using more than 30 per cent. of Para rubber. The other three companies referred to are the General Electric Co., the Standard Underground Cable Co., and J. A. Roebling's Sons.

Mr. Ames: But we are using wires made by the Standard Underground Cable Co., by the Hazard Mfg. Co., and the Okonite Co. that pass the tests.

The report was further discussed by Messrs. Morss, Langan, Eckert, Porter and Ham; the position of the manufacturers being, in brief, that to require 70 per cent. of dry inorganic mineral matter would make the product unnecessarily brittle and short-lived. But to allow the use of bituminous matter or wax for the purpose of making the insulation more durable makes it impossible to apply the chemical test to make sure of the presence of 30 per cent. of rubber. Mr. Morss suggested, therefore, that the only solution of the dilemma would be for the buyer to send his inspector to the factory and see the rubber weighed out and put into the compound. Being assured of a sufficiency of rubber, the buyer could then allow the maker to use his own judgment as to the composition of the other 70 per cent. Mr. Ames agreed that this would be satisfactory. The manufacturers declared that by insisting on rigid specifications the railroads could easily impose upon themselves a tax of 50 cents a pound for material not so good as could be furnished for 30 cents a pound were the maker allowed to exercise his own discretion. The report was accepted as a progress report and the meeting took up the report of the special committee on spetcacle castings, etc., as given in the Proceedings of the September meeting (page 37 of the pamphlet; page 272 of the *Railroad Gazette*). There was a proposition to approve the committee's conclusions down to the paragraph concerning the upward inclination of the semaphore arm, but the matter was finally laid on the table; and subsequently, when the meeting voted unanimously in favor of the upward inclination, it was the general feeling that action on the committee's work was unnecessary, if not inconsistent. This vote in favor of the upward inclination was taken after a very brief statement of its advantages by Mr. Rudd, and expressions of favor by one or two other members, but no discussion. The vote was simply on the question of the upward inclination, the further question of the number of indications (whether a two-position or a three-position signal) was not touched upon, and it was voted at this point to close the discussion.

The next subject was that of lamps, which was reported on by Committee No. 12, C. C. Rosenberg, Chairman. An abstract of this report is given in another column. Mr. Rosenberg explained that experiments with oil had not been fully carried out, for lack of time; and after a brief discussion the committee was instructed to make such investigations as might be necessary and then report specifications for oils for various uses; for a one-day lamp, a five-day lamp, etc. The discussion on oil brought out the fact that the Lake Shore and certain other roads use only one kind of illuminating oil; that required by the United States lighthouse standard. Samples were shown of a glass reflector made by the Corning Glass Works, for use in switch and signal lights, which is said to give 20 per cent. more light than a parabolic or a spherical reflector. The report was accepted.

After the conclusion of the discussion on lamps the papers of Mr. J. A. Peabody (published in the *Railroad Gazette* last week), and of Mr. E. L. Adams (published in this issue) were accepted without reading, and the authors thanked for them. Next came an elaborate paper by Dr. William Churchill, of the Corning Glass Works, on "The Roundel Problem." This paper, which was a long one, is deferred to a future issue. Dr. Churchill read to the association its salient features. This closed the Wednesday afternoon session.

The first speaker Wednesday evening was Dr. C. H. Williams, of Boston, whose experiments with signal lenses were reported in the *Railroad Gazette* last week, page 346. Dr. Williams showed his pocket photographic wedge and explained how it is used, three electric lights of widely differing intensity being fixed to the wall of the room for this purpose. The accuracy and refinement of the wedge readings was questioned, but Dr. Williams asserted that they were satisfactory for all practical purposes. In testing a signal light, or other small light, at a distance of half a mile, through the atmosphere, it is impossible to employ the precise methods of a laboratory test.

Following Dr. Williams, Dr. N. M. Black gave the results of some comparative tests which he had made of colored signal glasses of different makers.

Following the discussions of the evening, the association heard two propositions to amend the constitution, and voted to double the salary of the secretary, making it $300 a year. The first proposed amendment was offered in behalf of the associate members, most of whom are "supply men," providing that they be put on the same basis as honorary members; that is to say, to have all privileges except voting and holding office. The second proposition was to have two vice-presidents, one in the east and one in the west, so that meetings held in New York and Chicago would never lack a presiding officer. These propositions go over to the next meeting.

On Thursday morning little was done beside electing officers. The question of a membership badge, which had been decided on Tuesday by a small majority, was reconsidered, and it was decided to have a gold and enameled badge; but the design was not fully settled and the whole question was referred back to the executive committee. In accordance with action taken several months ago, each of the members present at this meeting wore on the lapel of his coat a numbered button. The Treasurer reported $1,159 in the treasury.

The election of officers for the ensuing year resulted as follows: President, C. H. Morrison (Erie Railroad, Jersey City, N. J.); Vice-President, J. A. Peabody (C. & N.-W., Chicago, Ill.); Secretary, H. S. Balliet (Grand Central Station, New York City); Fourth Member of Executive Committee, J. C. Mock (Electrical Engineer, Detroit River Tunnel Co., Detroit, Mich.). Mr. Mock is the retiring President and Mr. Morrison is promoted from the office of Vice-President. Washington, D. C., was selected as the place for the next annual meeting.

EXHIBITS.

Adams & Westlake Co., Chicago.—Switch and signal lamps; long burning founts.

Battery Supplies Co., Newark, N. J.—Gladstone-Laland batteries.

Bryant Zinc Co., Chicago.—Shoenmehl's primary battery.

Continuous Rail-Joint Company of America, Newark, N. J.—Rubber and fiber insulated joints.

Dayton Mfg. Co., Dayton, Ohio.—Silvey storage battery for car lighting and for signals.

Dressel Railway Lamp Works, New York City.—Switch and signal lamps; long-burning founts; 32-oz. oil cup of stamped metal.

Edes Mfg. Co., Plymouth, Mass.—Batteries, zincs and coppers.

Edison Mfg. Co., Orange, N. J.—Edison primary battery.

Electric Storage Battery Co., Philadelphia.—The "Chloride Accumulator."

Fairbanks, Morse & Co., Chicago.—Six h. p. gasolene engine and generator; velocipede hand car; gasolene velocipede car with double outrigger; No. 14 section-gang gasolene 7 h. p. motor car, to carry 10 men and draw a trailer; No. 15 inspection car, to carry 6 passengers.

General Storage Battery Co., New York City.—Bijur "High-Duty" storage batteries.

Gordon Battery Co., New York City.—Improved Gordon cells.

Gould Storage Battery Co., New York.—Storage batteries.

Hayes' Track Appliance Co., Geneva, N. Y.—Hayes' lifting derail and Hayes' pivot derail.

National Battery Co., Buffalo, N. Y.—"Unit" accumulators.

National Carbon Co., Cleveland, Ohio.—Wet and dry Columbia batteries.

Railroad Supply Co., Chicago, Ill.—The Chicago crossing signal.

United States Battery Co., New Rochelle, N. Y.—Storage batteries.

Weber Railway Joint Mfg. Co., New York.—Insulated joints.

Westinghouse Machine Co., East Pittsburg, Pa.—Storage batteries.

The Evolution of the Coal Car.

BY C. H. CARUTHERS, YEADON, PA.

"Coals" were first carried from the headings of the collieries of the English "North Countree," in wicker baskets known as "corves," upon the shoulders of men, and sometimes of women, to the foot of the shaft and thence up steep ladders to the pit's "eye." As the workings became more remote, and the shafts were deepened to reach lower seams of coal, hoisting machinery was introduced and the bail of the corf was formed into a U at its center to enable it to hang evenly upon the hook at the end of the hoisting rope.

Small trucks, or "Rollies," were also built upon which the corves were drawn or pushed to and fro, both in the pit and at the top, and these were soon made large enough to carry several corves at once. To enable the rollies to be handled easily upon the rough floor of the pit, planks were laid in parallel lines to form a roadway for the wheels. Some rollies for use at the top only were made in the form of a sled. After the coals arrived at the surface they were emptied into ordinary carts or wagons and hauled to the nearest point of consumption, or to the waterside for shipment to more distant places.

Owing to the wretched condition of the highways, it was soon found necessary to follow the practice adopted in the mines, of placing parallel lines of planks for the wheels of the wagons to travel on. Vertical planks were later placed at one side of each line to prevent the wheels slipping off into the frequent "chuck-holes"; and when iron coverings for the planks, and later still, rails entirely of iron, came into use, this feature of a flange formed upon one side of the rail was retained, for a time.

The experience of the passing years, and the desire to transport coals more rapidly, and in greater quantities at the same time, caused the building of a hopper-shaped type of wagon for this traffic alone, having a capacity of two and one-half tons. Experiments had proven the advantage of flanges cast upon the inner periphery of the wheels. This improvement being adopted upon the new type of wagon, caused the rapid disappearance of the flanges attached to the rails.

Thus far we have considered conditions prevailing at English collieries, the birthplace of the coal car, from 1630 to 1800. The success with which stationary steam engines had performed various duties about the pits during these later years induced the more progressive colliery owners and operatives to consider the construction of such an engine in locomotive form as a substitute for horses in drawing the wagons to and from the pits. These experiments have been described so often that it will suffice our purpose to say that among the engines constructed by Stephenson, Blenkinsop, Hedley and others, the "Puffing Billy" of Hedley, built in 1803, seems to have most fully met the early demands of the service, and thereafter locomotives of that type became numerous about the collieries, and continued at work for many years. An old book in the writer's library, which was published in 1839, shows two such engines in a view of a colliery. One is shown drawing a train of the wagons last described, and the other stands nearly off the rails—perhaps awaiting repairs, to which its long years of service doubtless richly entitled it. The speed of these engines would now be considered very slow, but the following extract from the work referred to will show how it was regarded in those days of long ago: "Sometimes a dozen or more wagons are dragged by one engine. A stranger is struck with surprise and astonishment on seeing a locomotive engine moving majestically along the road, at the rate of five miles an hour, drawing along from 10 to 14 loaded wagons; and his surprise is increased on witnessing the extraordinary facility with which the engine is managed. This invention is a noble triumph of science."

The improved service obtained by the use of the locomotive suggested possibilities in carrying other freight than coals, and even the idea that eventually passengers might be transported in this manner at a higher speed and in greater numbers than was being done by the stage coaches, was entertained by the more daring spirits; and again referring to the old publication named, we next find an engraving of a colliery in which a rude type of passenger carriage is shown attached to the end of a train of coal wagons, drawn in this instance by a rope from a distant stationary engine, a system of haulage followed in some localities at that time.

Although coal wagons were drawn in longer trains and at greater speed after the locomotives just described had superseded horses, the size and shape remained about as before until the successful results obtained from Stephenson's famous "Rocket" in 1829 increased the power and speed of the locomotive, and opened a new era in railroad practice. Within a few years thereafter a wagon of rectangular form and greater carrying capacity was designed, and this latter type remains practically the standard of all coal wagons used on the railroads of the United Kingdom to-day, having undergone but little change since its inception over 50 years ago.

Meanwhile the humble corf, the great ancestor of all coal wagons or cars, continued to be used in its subterraneous gloom, in its original form, at least until about 1840, as numerous other views of collieries shown in the work already referred to, reveal this very useful appliance in service in its original form; but between 1835 and 1840 its place began to be taken by rectangular boxes, of wood or iron, with the wheels rigidly attached thereto; but all to this day retain the ancient name of corf. During a visit to Pemberton colliery in Lancashire, England, a few years ago, the writer observed that the corves used at this queen of English pits were flangeless, and were guided by the men handling them after the manner followed with push-carts.

In America the earlier coal cars (we must follow American orthography and nomenclature now) were naturally a replica, at first, of those used in England, but after 1855 the eight-wheel type with its greater carrying capacity became the favorite and steadily increased in size until its development culminated in the monster steel car of 100,000 lbs. capacity, so generally used to-day. In American mines the coal has long been brought to the surface in mine cars having a capacity of about 2,600 lbs., or about five times that of the English corf.

Having traced the coal car from its origin in those misty days of long ago in lands beyond the sea, to its highest development in this western world; and having seen it ever in the forefront of aggressive suggestions in railroad practice, let us briefly consider a few of the successive types of its development as shown in the accompanying illustrations.

The corf is shown in Fig. 1. Its name is from the Low German and Dutch languages, and means a basket. In High German it is spelled korb. This word is originally derived from the Latin, corbis, which also means a basket. The plural, as has doubtless been noticed by the reader already, is corves.

Figures 2 and 3 present the rolly in the two forms previously described.

The wagon, as used until about the middle of the last century, is reproduced in Fig. 4, and Fig. 5 deals with its succeeding type, which is still so extensively used in Great Britain and on the Continent.

Fig. 6 now takes up the American features of the subject, and shows the mine car, or wagon, generally used in American mines, while Fig. 7 illustrates the type of coal car used in great numbers on American railroads from 1851 or 1852 until within the past 35 years; in fact, some were still in service in 1900. In this car, or "dumpy," as it was generally called, the bottom was of hopper form and the drop-doors were held shut by a simple device freer from trouble than some of the complicated schemes now used for the same purpose, and which seldom came open in transit, although the writer once witnessed an amusing exception. While returning from school he was enjoying the breeze which swept through the train on a hot afternoon, when suddenly a freight train passed on the westbound line, and at the same instant a dense white cloud poured into the coaches through the open doors and windows and set everyone sneezing like a parcel of hay-fever patients. The train was promptly stopped and we dismounted to investigate. In the distance could be seen the rapidly vanishing freight train and extending back to and beyond us, was a narrow white line. One of these dumpies used by a lime company was attached to the rear of the train and its drop doors had become unfastened and were spreading its snowy load down its path.

The springs of these cars consisted simply of two pieces of tough white oak wood separated by distance pieces and attached as shown, to the journal boxes and the side sills. A similar spring, set vertically, was also used at the bumper.

A few were built with pedestals and springs of india rubber or spiral steel, but most of those used in the bituminous coal fields of western Pennsylvania were of the type first described. The journal boxes were of a very simple design and consisted of a flat upper piece with an oil box at its front, and recessed on its under side to receive the top of the brass (and they *were* of brass in those days), and a semi-circular sponge cellar which was held in place by the same bolts which secured the entire box to the wooden springs. The brake was formed of a cross-shaft having double-cams on the ends, and a long lever at one end by which the cams were made to press against wooden brake-blocks suspended between the wheels. A few of these cars were made with side doors in the center panels to facilitate unloading at certain points, and some were also made without the hopper, using the side openings only. These were of two patterns; one with the small doors in the center panels as already mentioned, and the other having the entire side framing covered by two doors suspended from the top sill.

Between 1854 and 1860 the Philadelphia & Reading Railroad Company built large numbers of eight-wheel coal cars of the design shown in Fig. 8. This car contained several peculiarities. First, its line of draft was co-incident with the center line of the body framing. While this arrangement may have been satisfactory on the home road, it proved otherwise elsewhere when the practice of later years brought the cars into service on lines where the

general practice of placing the body framing above the line of draught caused these higher bodies to often over-ride the P. & R. car with disastrous results. The coupling was also effected by a large eyebolt at one end of the car which carried a three-link coupling chain and faced a hook of English type attached to one end of the next car, and the outer end of the chain was thrown upon this hook. It will be seen that such an arrangement necessitated keeping all such cars with the blind end of one car facing the hook of another, and caused no little "remark" on the part of trainmen when these cars passed on to other roads where the "Y" shaped approaches to sidings often turned a car end for end.

Fig. 1—Corf.

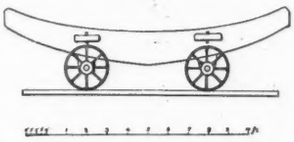


Fig. 3—Outside Rolly, Sometimes Used Without Wheels.

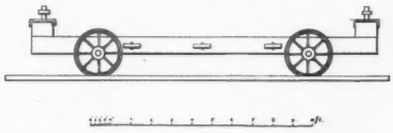


Fig. 2—Rolly. Carrying Four Corves.

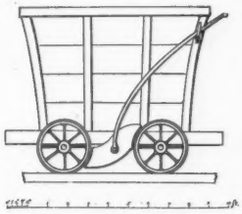


Fig. 4—Coal Wagon, 1840.

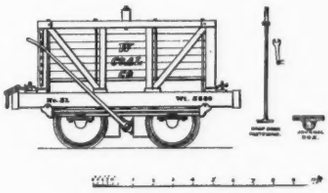


Fig. 7—Dumpy, 1853.

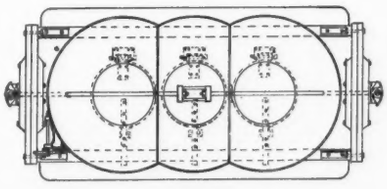


Fig. 9B.

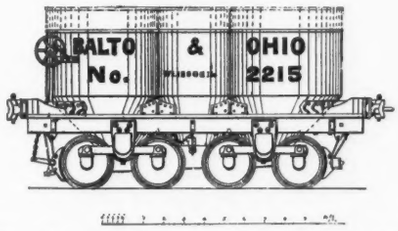


Fig. 9A—Baltimore & Ohio R. R., and Tributary Lines Iron Hopper Car, 1877.

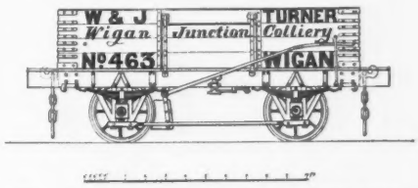


Fig. 5—English Coal Wagon, 1855-1905.

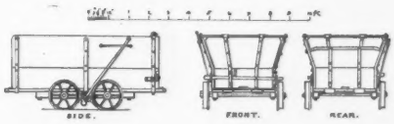


Fig. 6—American Mine Car or Wagon.

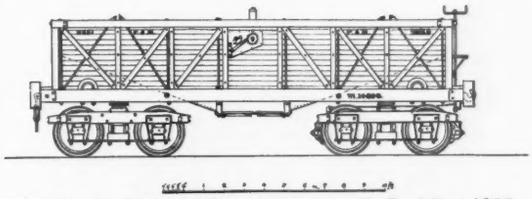


Fig. 8—Philadelphia & Reading R. R. After 1855.

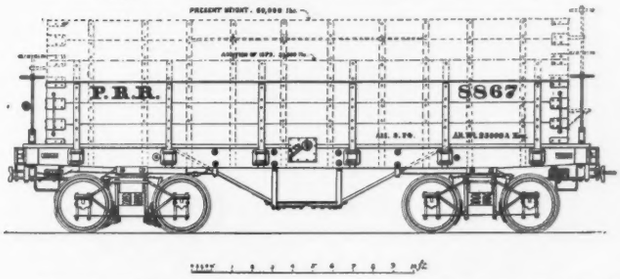


Fig. 10—Coal Car First Built by Pennsylvania R. R. Co. in 1874, Dotted Lines Show Later Additions to Increase Capacity.

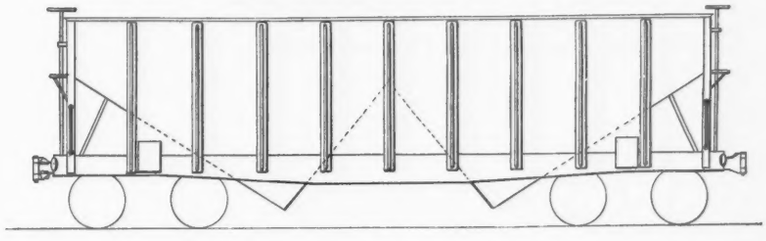


Fig. 11—Pressed Steel Car, 1898. 100,000 lbs. Capacity.

Each of the cars carried two numbers, as at the time of their construction and subsequent early service it appears that the Reading and a number of other railroads considered each four wheels a car. Through some error difficult to understand, two of the largest companies in the Western Pennsylvania Bituminous coal field placed an order in 1861 for 350 coal cars of almost exactly this pattern, and including all of the objectionable features except that draught hooks were placed at each end, and single numbers only, were used on each car. Yet these 350 cars were intended for use on the Pennsylvania Railroad and its allied lines where car construction differed so radically from that of the Reading, where these coal companies sent but few of their cars in those days. The error soon became apparent, and after about three years service the entire lot was sold and replaced partly by a somewhat similar car built on lines conforming to Pennsylvania Railroad standards, and equipped with drawheads and cast-iron dead blocks. The sills were also above the line of draught as at present, and the bodies were wider and shorter than the Reading car. The remainder of the new lot was filled with gondolas, as just at that time a demand for such cars seemed to have arisen in the coal trade. These gondolas were flat bottomed, but had small trap doors at the center.

Fig. 9 will recall to many persons a peculiar car which was used successfully for many years on the Baltimore & Ohio Railroad and on some of its connecting lines. It first came to the notice of the writer in 1877, at which time a number were brought to the Pennsylvania Railroad for the use of a coal company shipping coal to Baltimore. I do not know when the first of the type was built, but have seen a number yet in service on the Cumberland & Georges Creek R. R., at Cumberland, Md., in 1902. The courtesy of the General Manager of that road, Mr. Milholland, has enabled me to prepare a correct drawing of the car. The heavy lines show the dimensions of the '70s, and the dotted lines indicate the additions of later years. The car consisted of a sheet-iron body divided into three semi-cylindrical parts, each of which had a funnel-shaped bottom closed with a drop door. These compartments were carried on a simple type of frame, which it will be noted was below the line of draught, and was in turn carried on two trucks of very

few parts and set closely together. The drawbars were of a continuous type. During times of heavy grain traffic, these cars were often cleaned out and loaded with wheat, etc., the tops being covered with tarpaulins, and are said to have been quite satisfactory to the grain dealers. All cracks, bolt holes, etc., were carefully closed before loading the grain in bulk.

The type of car shown in Fig. 10 was designed at Altoona by the P. R. R. Co., in 1874; and great numbers were afterward built on these lines until the advent of the pressed steel car a few years ago. The dotted lines show the successive increases in size and capacity made by additions to portions of the body of the car. The trucks shown were also replaced in later years by a heavier type. Large numbers of these cars are in service on the principal American railroads, and doubtless many years will pass away ere they finally disappear from the lines.

The latest development of the coal car is that built of pressed steel and having a carrying capacity of 100,000 lbs. It has become so well-known during the past five years that a mere mention is all that is necessary here, and the sketch of it in Fig. 11 shows the principal parts only, and is merely given for purposes of comparison.

Concrete Curbing for Station Platforms on the C., M. & St. P.

Eight or ten years ago the Chicago, Milwaukee & St. Paul began to replace its wooden station platforms with brick. For a number of years wooden curbs were used for these brick platforms; but because of the temporary character and other unsatisfactory features of the wooden curbs, about four years ago it was decided to discard them for a permanent curbing material. The use of stone was begun, but the idea of applying concrete to this use occurred about the same time and was at once put into practice. The result has been entirely satisfactory, both as regards appearance, which was the primary consideration, and cost.

The concrete curbing is made in sections 3 ft. 6 in. long for depths up to 2 ft. Where the depth is greater than this the length is 3 ft. The drawings show two patterns, one 2 ft. deep and the other 3 ft. It will be noted that the outer edge at the top is neatly rounded and the ends are dovetailed into each other to preserve a good line when laid. The curbing is made of plain concrete, no reinforcing metal having been found necessary. The mixture is composed of 1 part of Portland cement, 2 of sand and 5 of crushed limestone broken not to exceed ½ in. cubes in size. Although a pretty rich mixture, it is not too rich for the exposed surfaces of the concrete, and it is considered cheaper to make the entire block of one mixture than to use two different mixtures.

The blocks are cast in wooden molds, of which there are a sufficient number to keep a crew constantly busy. They are made at two different points on the system and shipped where needed in whatever quantity desired. In shipping, the sections are packed in shavings or front-end cinders to prevent chipping or other injury. No trouble of this sort has been experienced.

A view of the station at Hartland, Wis., with double-track platforms, is shown herewith, which exhibits the good features of this curb, and especially the neat appearance it imparts to the platforms. The top of the curb on the track side is made level with the top of the rail. A 2-ft. deep curb is generally used in this location. For the outer sides a deeper curbing is often necessary. The view shows a reverse curve in the platform edge, involving both concave and convex curb sections. Squared corners are avoided by the use of such sections, which are made to two standard radii.

The first design used was about 1 in. thicker at both top and bottom than the present design. The thinner curb has been found to answer all requirements. The cost for the 2-ft. curb is between 12 and 13 cents a foot, exclusive of loading and setting. The first year of its use (1902) about five miles were laid. In 1903 this increased to eight miles, and 1904 was about the same. The present year, however, promises to exceed this.

Station at Hartland, Wis., Showing Reverse Curve in Curbing.

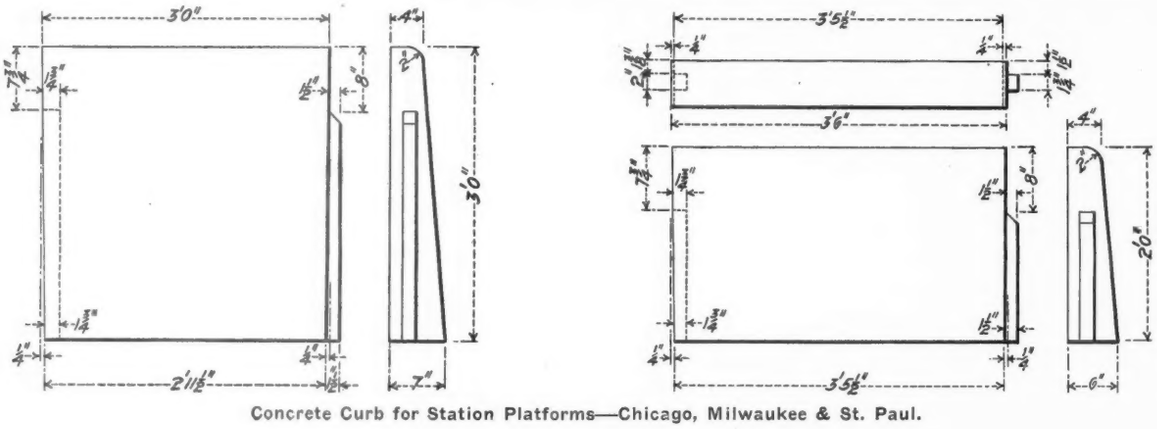
We are indebted to Mr. C. F. Loweth, Engineer and Superintendent of Bridges and Buildings, for the illustrations and information.

Rubber-Covered Wire.*

Rubber-covered wire for railroad signal installation is generally used either as aerial cable or as single conductor or cable for ground use. Under the latter heading may be grouped all wires running in trunking or other conduit upon or under the ground or in the usual forms of shelters for batteries and relays. While most rubber covered signal wire carries a current of very low voltage, that used in electric interlocking plants or in the charging circuits of storage battery installations is subject to pressures of from 110 to 600 volts.

The destructive forces affecting signal wires are severe and comprise mechanical injury, heat, moisture and chemical action. The most destructive force affecting the rubber insulation of an aerial cable is heat, and the same may justly be said of wires run in trunking above the ground. Wires buried below the ground are as a rule either continually wet or alternately wet and dry, and in many localities the ground where they are run is saturated with oil, brine or acid. Frost, by the heaving of the ground and distortion of the conduit, is a potent factor in shortening the life of rubber covered wire in signal work.

It is both wasteful and unsafe to use any signal apparatus or material that is less than the best that skill can make or money buy. The signal engineer with a laudable ambition to do good work often finds that his purchasing agent has an equally laudable ambition to get the best prices. These are generally secured through competition which unless guided and restrained by proper specifications, for the materials purchased, results in obtaining an article whose only merit is its low first cost. These same conditions are met to an even greater degree on contract work, where in the absence of rigid specifications, signal companies are often tempted to supply cheaper grades of material to enable them to underbid their competitors. Some companies, in fact, have brought undeserved discredit upon their apparatus or systems by the use of rubber cov-



Concrete Curb for Station Platforms—Chicago, Milwaukee & St. Paul.

*Report of Committee No. 13, A. Ames, Jr., Chairman, to the Railway Signal Association, read at Niagara Falls meeting Oct. 10-12. Abridged.

ered wires, the insulation of which while of good quality, was so thin as to be quite unsuitable, especially upon 110 volt work.

Some manufacturers by the excellence and uniformity of their products acquire reputations which enable them to command prices which are considerably in excess of those that yield a reasonable profit, and in buying rubber covered wires and cables for signal work a number of roads have purchased almost entirely from some one manufacturer. Until recently but few concerns made high grade rubber covered wire for signal work, and a great deal of wire has been used in signal installations which was totally unfit for the purpose.

There is no manufactured product in the purchase of which the buyer puts himself so thoroughly in the hands of the manufacturer as in rubber covered wires and cables. The manufacturers have shrouded the subject in as much mystery as possible. There is no disposition to pry into trade secrets, but the purchaser of any article is entitled to know just exactly what he is paying for.

Omitting, at this time, all cables, the committee suggests that rubber covered wire be considered under the following heads:

1. The copper conductor..
   a. Suggested requirements.
   b. Physical tests.
   c. Conductivity tests.
   d. Tests of tinning.
2. The rubber insulation..
   e. Suggested requirements.
   f. Physical tests.
   g. Chemical tests.
   h. Electrical tests.
3. Taping and braiding...
   i. Suggested requirements.
   j. Absorption tests.
4. Packing and shipping.

a. Conductors must be soft drawn, annealed copper wire, having a conductivity of not less than 98 per cent. of that of pure copper, . . . and provided with a heavy uniform coating of tin.

b. Each solid conductor must stand an elongation of 25 per cent. of its length in 10 in. before breaking. In torsion it must stand before breaking 30 twists in 6 in. It must be capable of being wrapped six times about its own diameter and unwound without showing signs of breakage after this process has been gone through twice. The tension and torsion tests will be made on separate pieces of wire.

c. The conductivity of the copper shall be determined by measuring the resistance of a length of the wire and comparing with Matthiessen's standard of copper resistance.

d. Samples of the wire shall be thoroughly cleaned with alcohol and immersed in hydrochloric acid of s. g. 1.088 for one minute. They shall then be rinsed in clear water and immersed in a sodium sulphide solution of s. g. 1.142 for 30 seconds and again washed. This operation must be gone through with four times before the wire becomes clearly blackened.

e. The vulcanized rubber compound must consist of not less than 30 per cent. of the best grade of fine Para gum mixed with sulphur and dry inorganic mineral matter only. The insulation must be tough, elastic, adhering strongly to the wire, homogeneous in character and must be placed concentrically about the conductor.

f. The rubber shall be so compounded and vulcanized that when test pieces taken from the wire (2 in. between jaws and ½ in. wide where possible) are subjected to a tensile stress, they shall show a breaking strain of not less than 800 lbs. per square inch and shall stretch to at least 3½ times their original length. The jaws to be separated at the rate of 3 in. per minute. A piece of the rubber insulation 4 in. in length must be stripped from the wire and marks placed thereon 2 in. apart. The piece must then be stretched until the marks are 5 in. apart, two minutes time being consumed in the elongation. Upon being released and allowed to contract, the original marks must not be more than 2½ in. apart. The rubber insulation must be subjected for one hour to a temperature of 260 deg. F., using dry heat, and at the expiration of that time must be tested for elasticity, elongation and permanent set and must conform to the specifications therefor.

g. The vulcanized rubber compound will be subjected to any chemical tests that may be necessary to insure that only a proper grade of fine Para gum is being used and that no other ingredients are used in addition thereto except sulphur and dry inorganic mineral matter.

h. This paragraph prescribes the cross-section in circular mills, the thickness of the rubber insulation, the minimum resistance in megohms per mile and the dielectric strength for the various sizes. For No. 9 B. & S. gage the area is 13,090; thickness, $^5/_{64}$ in.; minimum insulation resistanse 900, and test voltage, alternating current, 4,000.

The test for insulation must be made upon all wire without braiding, and after 48 hours immersion in water at a temperature of from 65 to 75 deg. F. Tests must be made with well insulated battery and galvanometer, with not less than 150 volts, and reading must be taken after one minute's electrification. The test voltage must be applied to the completed length of wire after the insulation test for a period of five minutes, using alternating current from a generator and transformer of ample capacity.

i. The rubber insulation must be protected with a layer of cotton tape thoroughly filled with a rubber insulating compound, and lapped one-half its width. The tape must not adhere to the rubber and must be so worked on as to insure a smooth surface. The outer braid must consist of one layer of closely woven cotton braiding $^1/_{32}$ in. thick, saturated with a black, insulating, waterproof compound which shall be neither injuriously affected by nor have injurious effect upon the braid at a temperature of 200 deg. F.

j. Six inch sample of wire with cearefully paraffined ends shall be submerged in fresh water at 70 deg. F. for a period of 24 hours. The difference in weight of the sample before and after submersion must not be more than 10 per cent. of the weight of the sample before submersion less the weight of the copper and vulcanized rubber.

4. Packing and shipping. . . .

The manufacturer must provide at his factory all apparatus and other facilities needed for making the required tests, and give free access to the place of manufacture and opportunity to test at all necessary times. . . .

The committee expects to be challenged for its suggestion that a compound be used containing nothing but Para gum, sulphur and dry inorganic mineral matter, and it will doubtless be claimed by many that the life of the insulation will be increased by the admixture of a certain amount of bituminous matter, or mineral wax. The admission of any such substance renders the purchaser powerless to determine the most important fact of all, namely, whether he is getting 30 per cent. of a fine grade of Para gum in the compound.

Any grade of Para gum permissible in a high grade insulation will not contain more than 1.5 per cent. of resinous extract which may possibly increase on vulcanization to as high as 5 per cent. This much in a compound containing 30 per cent. of gum would yield .30 of 5 per cent. or 1.5 per cent. as the total percentage of resinous extract in the compound. Suggestion has been made that by limiting the total amount of extract obtainable by acetone and alchoholic potash to 5 per cent. of the compound that the proper grade of insulation would be insured. But the admission of 5 per cent. of extractive matter would permit the use of a lower grade rubber which might not have proper lasting qualities. The committee is inclined to seek a little further information on this point and have some tests made.

It is considered by some that the amount of free sulphur in the compound is highly important as affecting the copper and as permitting the process of vulcanization to continue under the action of any heat to which the finished wire may be subjected in use. The committee wishes to consider the value of this factor somewhat further before making a definite recommendation, and it may be that the dry heat test suggested may be of some service in determining the effect of free sulphur as well as in detecting readily the presence of partly combined resinous ingredients of low melting point when chemical facilities are not at hand.

It will naturally be asked "Why are so many tests necessary?" and the answer is that cheap and useless compounds can be made that will pass almost any one or two of the tests. For example, many substances could be introduced to give a high insulation resistance but which would deteriorate rapidly in service and the presence of which can easily be detected by the tensile strength of the insulation.

These and many other points lead naturally to the question as to how the purchaser at a distance from the wire mills is to be sure that his specifications are being lived up to. They must either be enforced or become a laughing stock. The answer is that where any quantity of wire is purchased the buyer should either send his inspector to the mills, arrange to use an inspector jointly with some other road or roads, or employ the service of some of the numerous inspection agencies or bureaus, who make a specialty of testing electrical material. Almost any signal engineer may, however, at slight expense get together simple apparatus for making most of the tests recommended except those for insulation resistance, and the puncture test. These latter require a more complicated and expensive equipment. . . .

Interurban Electric Railroads in California.

Interurban electric railroad development in California has lately been making big strides. San Francisco, Oakland, Los Angeles, Stockton, Sacramento, Napa, San Jose, San Bernardino, Santa Cruz, Bakersfield, Nevada City, Grass Valley, Marysville and Fresno are each the center of a system whose branches are being extended into the surrounding country. In many cases the electric lines are proving formidable competitors in interurban passenger traffic to the steam railroads. Indications are that they will shortly carry the competition into freight traffic also. Already the Los Angeles lines with their large passenger traffic have attempted to enter the field as freight carriers. They have been temporarily checked by a suit now pending in the courts which has been brought by the Southern Pacific Company to test the interurban

company's rights, under its franchise, to carry freight. A series of lines centering at Stockton is being developed expressly for the purpose of exploiting the rich fruit and vegetable producing lands along the fertile bottoms of the lower reaches of the Sacramento and San Joaquin rivers, for the transportation of their products and passengers to tidewater and to the markets of the San Francisco bay cities. These lines will be of very great value to the agriculturalists of this region as they will save the present long wagon haul to the river landings and railroad stations. It is not at all improbable that in time every interurban electric road in the state will become a freight carrier, for their franchises all contain a clause granting the right to carry freight. Applicants for electric railroad franchises in California have always demanded this privilege on the ground that it is essential to successful operation, because without it they would be unable to carry on their own tracks the necessary supplies for their repair shops and power houses and materials for keeping their wires and right-of-way in repair. As this right is granted in all the original electric line charters it is probable that the efforts of the steam railroad companies to restrict the electric lines, by law, to passenger traffic, will fail.

The success of electric railroads in California has been greatly stimulated by using water power from the high ranges back from the coast. The water courses on the western slopes of the Sierras have proved to be the cheapest sources of power obtainable. Great electric power plants have been built on the western flank of the range and are delivering electric energy at points as far as 225 miles distant from the point of generation, and this at a less cost to the consumer than power could be produced on the spot from fuel oil. As a result of this development the local power houses of all the interurban roads have been closed down or used for other purposes and current for the operation of the lines is drawn from the big electric power transmission lines. The Los Angeles interurban system, the largest in the state, gets its power from the Kern river plant, 110 miles distant; the Oakland system obtains its power from a plant on the South Yuba river, 140 miles away, and the San Jose system is supplied with power transmitted over 100 miles.

Wherever the interurban lines have come into direct competition for passenger traffic with the steam railroads they have come off victors. Last May, as a direct result of the competition of the Huntington-Hellman interurban lines, 25 regular passenger trains between Los Angeles and suburban points were withdrawn by the Southern Pacific after being operated at a loss for over 18 months. The points reached by this interurban line are Whittier, Santa Monica, San Pedro and Long Beach, the last three, popular watering places and ocean shipping points and all having a very large passenger traffic. Since their opening, the electric lines have had practically a monopoly of this traffic. At San Francisco a new ferry across the bay, known as the "Key Route," popularly suspected of being an auxiliary of the Atchison, Topeka & Santa Fe (although this has been repeatedly denied) has enabled the San Francisco & San Jose interurban line to deprive the Southern Pacific of the bulk of its North Oakland, Central Oakland, Berkeley and Piedmont passenger traffic, including a very large commutation travel. The popular belief in the interest of the Santa Fe is somewhat justified by the fact that the San Francisco & San Jose line connects and co-operates with the Santa Fe. The Southern Pacific's monopoly of passenger traffic is also disturbed or threatened by the Ocean Shore Electric Railroad, a double track line from San Francisco to Santa Cruz, as well as by a proposed extension of the San Jose & Los Gatos interurban line to Santa Cruz, a projected extension of the Huntington-Hellman system from Los Angeles to Oxnard, Hueneme and Ventura, and, later, possibly to Santa Barbara; a cross country extension of the Nevada City & Grass Valley electric line to Auburn, Lincoln and Marysville, and a line to be built west across the inner coast range in a direct line from the populous settlements in the fertile Walnut Creek and San Ramon valleys to Oakland. The promoters of several of these projected lines make no concealment of the fact that they intend to carry freight. The Ocean Shore Electric Railroad, which is incorporated with a capital of $5,000,000, has been surveyed and right of way secured along one of the most picturesque routes in the state, the whole being in close proximity to the sea and passing through Pescadero, Half Moon Bay and other good sized settlements which have hitherto had no railroad. It is intended to run trains between termini on a one hour schedule. The Southern Pacific trains on its south Pacific Coast branch take two and a half hours for this journey, and the time under the most favorable circumstances cannot be greatly shortened. Construction on the Ocean Shore line is now in progress.

In one respect, the electric lines have a great advantage over their rivals—they can build into districts which the steam lines are prevented from reaching by the topography of the country. For example, the Southern Pacific has thus far been unable to obtain a route with feasible grades into Lake County. These high grades are no serious obstacle to electric traction and an extension of the Napa Valley & Vallejo electric line is being built from Napa to Calistoga, the terminus of the Southern Pacific's Napa Valley Railroad, and thence to Lakeport, Lake County. An extension also of the Petaluma & Santa Rosa electric railroad is to be built to Napa and thence by a different route into Lake County.

An interesting development of co-operation between steam and electric lines is to be carried out in the building of the Western Pacific, the Gould line to the Pacific coast, on which construction, through the Feather River canyon, is about to be begun. Closely associated with this company are a number of electric lines which are to serve as feeders.

At the rate at which new electric railroads are now being projected and built, California will in a few years be well-served by interurban lines. It is not difficult to forecast their future. Although at present widely separated, it takes no expert to see that they are parts of a well considered railroad chain whose ultimate development includes the entire state from the Mexican to the Oregon boundary. Mr. Henry E. Huntington's association with many of them is so clearly defined that it is evidently his intention to develop out of these local parts a continuous network of electric lines paralleling every steam railroad in the state and entering many districts which the steam lines do not reach, with the possibility of a through electric line from one end of the state to the other.

Signal Lamps and Long Time Burners.*

To test the efficiency of lamps, burners, reflectors and oils, experiments were made with lamps furnished by Adams & Westlake, the Dressel Railway Lamp Works, and the Armspear Manufacturing Company. The representatives of these firms assisted in making the tests. Signal and switch lamps are now of much better quality than they were a few years ago. Solder, which got loose, has been abandoned, and lamps are riveted. Steel is used instead of tin plates, and the openings for ventilation have been rearranged so as to guard against extinguishment by wind on the one hand and by lack of ventilation on the other. By the use of a perforated cylinder and a cone the accumulation of moisture is more or less completely prevented. The question whether the standard makes of lamps would work well with the long time burners has been settled in the affirmative.

Experiments were made to test the ventilation of lamps. Placing the lamps against a wall, air was blown against them from a one-inch hose eight feet away, with a pressure of 30 to 80 lbs. The nozzle of the hose was gradually carried nearer to the lamp until the light was extinguished, but some of the lamps ventilated at the top could not be blown out.

To determine the efficiency of the long-time burner as a signal light, using different colors, tests were made in the evening of November 29 on the Lehigh Valley Railroad, 20 miles east of Buffalo. The longest possible range was 2.08 miles and at this distance all of the tests with red glasses showed the light to be very good. The greens were good at that distance, but the yellows could not be seen more than 1.05 miles. Lenses of two sizes were used, 4½ in. and 5⅜ in., with no appreciable difference. Further tests of the lights with red glasses were made the next night at a distance of 3.31 miles, at which the light was clearly defined. On a tangent 2 1-3 miles long, near Sayre, some tests were made with standard semaphore lamps in a heavy rainstorm to show the benefit or otherwise of reflectors. The lights were clearly defined in all cases, but were better when the reflectors were used.

In June and July last various burners were subjected to photometric tests, with and without lenses and reflectors. All the flames were adjusted to a height of ⅞ in. A one-day burner, flat wick, with a naked flame, gave 1.48 candle-power. Long-time burners, without reflectors, all burners removed from lamps, chimneys retained in place, gave from 0.28 to 0.35 c. p. Long-time burners with one-way reflectors gave, with spherical reflectors, from 0.41 to 0.43 c. p.; with parabolic reflectors, 0.83 c. p. In standard semaphore lamps, with 4½ in. and 5 in. lenses, of 3 in. and 3½ in. focus and one-way reflectors, long-time burners gave from 29 to 35 c. p. With four-way reflectors the efficiency of the light was much less. A number of comparisons between one-day and long-time burners showed the long-time burners to give 40 to 45 c. p., while the one-day burners gave from 52 to 70 c. p. In some duration tests, one long-time burner burnt 5 days 23 hours, giving, with parabolic reflecor, 33 c. p. at the start and 28 c. p. 4 days and 20 hours afterward. Another giving 21 c. p. at the start gave 17 c. p. 4 days and 10 hours afterward.

A glass reflector furnished by Adams & Westlake was found superior to any other kind of reflector tested.

The committee made some tests of oil, but did not finish its experiments. With nine lamps equipped with long-time burners the time required to consume 16 oz. of oil was from 112 to 180 hours. The saving which can be made by using long-time burners

*Abstract of the report of Committee No. 12, C. C. Rosenberg, Chairman, made to the Railway Signal Association, at its annual meeting at Niagara Falls, Oct. 10-12.

is shown by the following report from a division having 171 miles double and 158 miles of single track. The figures are taken from records of the last 12 months that the one-day lamps were in service and compared with the last fiscal year, long-time burners being in use.

		Material.				
Kind.	No. lamps.	Oil, gals.	Wicks, gross.	Waste, lbs.	Burners.	Chimneys.
One-day burner.....	805	17,690	36	1,789	411	...
Long-time burner.....	817	8,141	11	581	98	438

	Comparative Cost.		
	Material.	Labor.	Total.
One-day burner.....	$1,991.11	$14,534.96	$16,526.07
Long-time burner.....	900.28	7,072.30	7,972.58
Saved by long-time burner.	$1,090.83	$7,462.66	$8,553.49

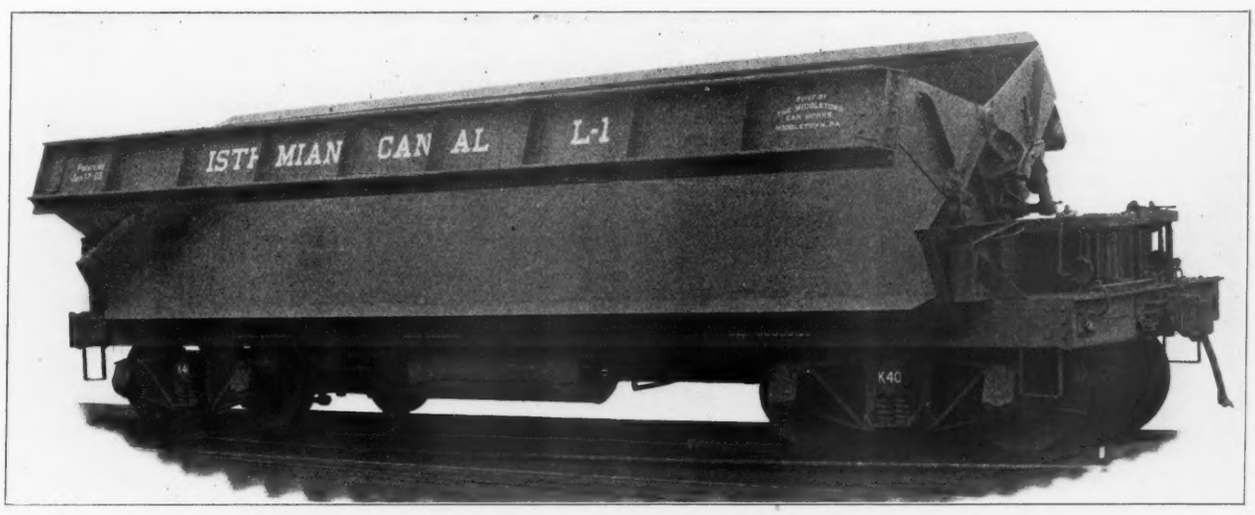
Average cost per year—one-day burner, $20.58; long-time burner, $9.76.

The committee presents a brief code of rules for the care of lamps. One of the requirements is that the lamp man shall cover his district at least twice a week, and one recommendation is that soft paper be used, rather than cotton waste or cloth, for cleaning lenses and reflectors.

The committee concludes that lamps should be made of steel and that the top draft is decidedly preferable because with it no moisture gathers on the inside of the lamp. In recommending the long-time burner the committee says that in all of the tests made the lenses were completely filled by the light from a ⅞-in. flame. In practice, however, the flame may be made higher, perhaps 1¼ in. All of the lights gave good red and green signals at two miles, and good yellow signals at one mile. The long-time burner will give efficient service for four days; and this is especially true if the glass reflector is used. The men to take care of lamps should be selected with care, and educated to study the lamps in their charge so as to be able to anticipate trouble.

Dump Car for the Panama Canal.

The accompanying illustration from a photograph shows a sample dump car of the King-Lawson type which has been built by the Middletown Car Works, Middletown, Pa., for the Isthmian Canal Commission, and will be shipped to Panama. The car will be thoroughly tested for its adaptability to work on the Panama Canal. It has a capacity of 80,000 lbs., is built entirely of steel and will dump on either side of the track. The light weight is 53,000 lbs. Ten of these cars are now in service on the Lackawanna handling all sorts of material. They have been tested with rock, sand, clay, earth, pig iron, iron ore and ingots, and so far have not developed any failures. One of these cars, the first which was built, has a capacity of only 50,000 lbs., but the other nine are all of 80,000 lbs. capacity. The body is dumped by two inclined air cylinders placed under the floor on each side of the center sills.



King-Lawson Dump Car for the Panama Canal.

The Railroad from the Red Sea to the Atbara.

About a year ago work was begun on a railroad in upper Egypt from the Red Sea to the Nile. Little has been said about it, but it is now reported that about 180 miles of track have been laid, leaving about 130 to complete the road, whose Red Sea terminus is not at Suakim, which has always been the port from which caravans have crossed to Khartum, but at a point 30 miles further north, where a better harbor is being built. This has been called Barud, but will be named Port Soudan. Thence the road pursues a southwesterly direction to the point where the Atbara falls into the Nile. Work was begun at both ends at once. There is very heavy work on the road, and many bridges, for though there is little rain, when it comes it comes in torrents. The railroad may be said to be a competitor of many of ours, for a chief reason assigned for building it is to encourage cotton-growing in the Soudan, by giving a cheap outlet to the sea.

Crop Export Movement.

In the movement of the surplus crops of the United States for export there are features of much concern to competitive ports, to the railroads, to steamship companies, and to the producers and handlers. An examination of the various problems involved is contained in a bulletin recently issued by the Department of Agriculture, by Frank Andrews, transportation expert, entitled "Crop Export Movement and Port Facilities."

The proportion of cotton, wheat, flour, and corn exported from Atlantic ports decreased during the 21 fiscal years ending in 1904, while the percentages exported from Gulf ports increased. The Gulf exported 44 per cent. of the total cotton exports of the United States during 1884-1888 and 60 per cent. in 1905, while the Atlantic seaboard exported 55 per cent. in 1884-1888 and only 34 per cent. in 1905. In the wheat trade the Atlantic ports share declined from 59 per cent. during 1884-1888 to 20 per cent in 1904, and the Gulf ports increased their exports from 2 per cent. to 55 per cent. during the same time. The Gulf exported 12 per cent. of the wheat-flour exports in 1904, a large relative increase over previous years.

No comparison is made with the first part of 1905 because on account of railroad rate wars and the small wheat crop it was an abnormal year. The percentage of the corn export trade handled by the Atlantic ports and by the Gulf ports changed but little during the period 1884-1904, but in 1905 the Gulf ports gained materially. The abnormal conditions in the export grain trade during the fiscal year 1905 were marked by a drop in the percentage of wheat exported from the Gulf ports from 55 per cent. in 1904 to 1 per cent. in 1905, and by the rise in the exports of corn from those ports from 16 per cent. to 29 per cent. during the same time.

During the 21 years ending with 1905, the Atlantic and Gulf ports together handled from 94 to 99 per cent. of the exports of cotton and from 87 to 91 per cent. of the corn exported; but, in the wheat and flour trade, a considerable amount was exported from the Pacific coast. In 1905 only 6 per cent. of the wheat exported went from Atlantic and Gulf seaports, while the Pacific coast cities handled 92 per cent. Of the wheat flour exported in 1905 the Atlantic and Gulf ports shipped 60 per cent., the Pacific ports 35 per cent., and 5 per cent. was exported across the border into Canada and Mexico.

The two groups of Atlantic and Gulf ports are compared in the following statement of the percentages of the national exports passing through them:

	Cotton		Wheat.		Wh't flour.		Corn	
Years ending June 30—	Atlantic. Per ct.	Gulf. Per ct.	Atlantic. Per ct.	Gulf. Per ct.	Atlantic. Per ct.	Gulf. Per ct.	Atlantic. Per ct.	Gulf. Per ct.
1884-1888.....	55	44	59	2	81	1	74	15
1889-1893.....	52	47	53	9	81	1	74	13
1894-1898.....	44	54	53	10	79	3	71	19
1899-1903.....	37	60	47	22	74	6	75	16
1904.....	33	65	20	55	63	12	74	16
1905.....	34	60	5	1	53	7	59	29

In 1904 nearly one-fourth of the cotton crop of the United States was produced in Texas, and more than one-half in Texas, Mississippi

and Georgia. Much of the cotton raised in Mississippi reaches New Orleans and Memphis, and some goes to Mobile and Savannah. The leading primary market for Georgia cotton is Savannah, while Galveston receives, in addition to a large share of the Texas crop, considerable quantities from the Indian Territory and Oklahoma. More than 5,000,000 bales were shipped to Galveston, New Orleans, and Savannah during the crop year ending August 31, 1904, and these three cities exported during the corresponding fiscal year nearly three-fourths of the total exports of cotton from the United States.

Most of the surplus wheat of the United States is produced in the country lying west of the Mississippi river, north of Oklahoma, and east of the Rocky Mountains. Owing to the great quantity of flour manufactured in Minneapolis, the receipts of wheat at that city are larger than those of any other in the United States. In 1904 they amounted to 87,000,000 bushels. In the same year the receipts of wheat at Kansas City were 39,000,000 bushels; at Duluth, 27,000,000; at Buffalo, 26,000,000; and at Chicago, 24,000,000.

The greater part of the corn crop of the United States is produced in the Mississippi Valley south of the lower limits of the Great Lakes and the southern boundaries of Minnesota and South Dakota, and north of the Ohio river and the northern boundaries of Arkansas and Oklahoma. The production of this region, together with the crop of Texas, amounted in 1904 to 1,574,000,000 bushels. In 1902, 1903, and 1904 Illinois was the leading state in the production of corn, Iowa second.

Corn appears in the export trade of the United States in the form of grain and also as an element of value in live stock and animal products. The practice of farmers in sending their corn to market "on the hoof" explains the great difference between the quantity of corn harvested and the quantity received in the form of grain at the various inland trade centers. The leading primary market for corn is Chicago, and during the six years ending with 1904 an average of 101,000,000 bushels of corn per annum was received there. This was more than the combined receipts at Buffalo, St. Louis, Peoria, Kansas City and Cincinnati. The total receipts of corn at all these six trade centers, although amounting to nearly 200,000,000 bushels, equaled only 8 per cent. of the corn crop of the United States.

The cost of exporting a 500-lb. bale of cotton from the interior of Texas to Liverpool, via Galveston, is estimated at $6, including freight charges, insurance, office expenses, and minor charges. The cost of exporting a bale from the interior of Alabama via Mobile to Liverpool, was estimated in 1897 to be $7.89, and in 1840 to be $18.15. It is also estimated that the charges for shipping a bushel of wheat by rail from Buffalo to New York amount to about 6.12 cents, allowing 5 cents for freight, 0.625 cent for weighing, 0.15 cent for elevator charges, 0.15 cent for trimming, and 0.22 cent for insurance.

Although New York's relative importance as a port from which agricultural products are exported is diminishing, it is, nevertheless, the third port of the world in the value of all exports and imports, being surpassed only by London and Liverpool. During the fiscal year 1904, 61 per cent. of the imports and 34 per cent. of the domestic exports of the United States passed through New York, and the total value of all classes of its foreign trade exceeded $1,160,000,000.

Certain characteristics of foreign trade in farm products pertain to each prominent American and Gulf port. About one-half of the wheat and cattle exported from Canada via the United States passes through Portland, Me. During the fiscal year 1905, 18,514 Canadian cattle and 2,531,449 bushels of Canadian wheat were exported through this port. Boston's exports consist chiefly of grain, flour, cotton, cattle, and meat, and include nearly two-fifths of the exported fresh beef. In 1904 Philadelphia exported $9,000,000 worth of meat and meat products, $8,000,000 worth of flour, $4,000,000 worth of cattle, and $4,000,000 worth of corn. Baltimore's exports of flour in 1904 amounted to $12,000,000; of lard, $8,000,000; tobacco, $8,000,000; corn, $6,000,000; cattle, $6,000,000; and cotton, $5,000,000. The leading farm products exported from Newport News that year were flour, $4,000,000; cattle, $3,000,000; and corn, lard, tobacco, and cotton, about $1,000,000 each. Norfolk's leading exports were lard, flour, tobacco and cattle. Cotton made up $18,780,288 out of $19,085,221 for all exports at Wilmington, N. C., in 1904. The cotton exports from Charleston, S. C., that year were valued at $2,300,172, and all other exports at $30,503. At Savannah and Pensacola, also, cotton is the chief product exported. Between Hampton Roads and New Orleans, no other city exports so great a variety of articles as Mobile, yet about one-half the value of exports in 1904 was in cotton and one-eighth in grain and flour. New Orleans and Galveston are the leading cotton ports and are coming to be among the first in the export of grain.

A Berlin station official proposing a substitute for the present method of shipping passenger's baggage in Germany, enumerates as follows, the clerical work now required, after the baggage has been weighed and labeled: "The clerk fills in on the baggage receipt the date, the number of the train, the number of pieces of baggage, the number of tickets presented with the baggage, the destination, the route, the total weight, the excess weight, and the amount paid."

The National Machine Tool Builders' Association.

The fourth annual convention of the National Machine Tool Builders' Association, was held at the Hoffman House, New York City, October 16 and 17. This association consists of 45 members, as follows:

The Hendey Machine Co.	Torrington, Conn.
B. F. Barnes Co.	Rockford, Ill.
Detrick & Harvey Machine Co.	Baltimore, Md.
Baush Machine Tool Co.	Springfield, Mass.
P. Blaisdell & Co.	Worcester, Mass.
Draper Machine Tool Co.	" "
Prentice Bros. Co.	" "
F. E. Reed Co.	" "
Whitcomb Manufacturing Co.	" "
Woodward & Powell Planer Co.	" "
Norton Emery Wheel Co.	" "
Stockbridge Machine Co.	" "
C. E. Sutton Co.	Toledo, Ohio
Flather & Co., Inc.	Nashua, N. H.
Mark Flather Planer Co.	Nashua, N. H.
Binsse Machine Co.	Newark, N. J.
Gould & Eberhardt.	Newark, N. J.
W. P. Davis Machine Co.	Rochester, N. Y.
W. A. Wilson Machine Co.	Rochester, N. Y.
The American Tool Works Co.	Cincinnati, Ohio
Bradford Machine Tool Co.	" "
Bickford Drill & Tool Co.	" "
Cincinnati Milling Machine Co.	" "
Cincinnati Planer Co.	" "
Cincinnati Shaper Co.	" "
Dietz Machine Tool Co.	" "
Fosdick Machine Tool Co.	" "
Greaves, Klusman & Co.	" "
Lodge & Shipley Machine Tool Co.	" "
R. K. Leblond Machine Tool Co.	" "
The King Machine Tool Co.	" "
The Queen City Machine Tool Co.	" "
Rahn, Mayer Carpenter Co.	" "
Schumacher & Boye	" "
John Steptoe Shaper Co.	" "
Hamilton Machine Tool Co.	Hamilton, Ohio
Springfield Machine Tool Co.	Springfield, "
Owen Machine Tool Co.	" "
Fairbanks Co.	" "
Jones & Lamson Machine Co.	Springfield, Vt.
The Ridgway Machine Tool Co.	Ridgway, Pa.
G. W. Fifield	Lowell, Mass.
Windsor Machine Co.	Windsor, Vt.
Builders' Iron Foundry	Providence, R. I.
Bullard Machine Tool Co.	Bridgeport, Conn.

The opening session was devoted to the reading of the minutes of the last meeting, reports of standing committees, and a discussion of general trade conditions. Immediately after the morning session the members of the association and a number of invited guests were tendered an excellent luncheon by the *American Machinist*. The afternoon session was devoted to unfinished business and to the report of the committees on motor drive and on the apprenticeship system. An address was also given by Charles A. Moore on the Conditions and Possibilities of Trade for American Machine Tools Abroad. No definite conclusions were arrived at in regard to motor drive, the report on this subject being referred back to the committee. The Tuesday morning session (October 17) was devoted to unfinished business and to an address by Fred J. Miller on Government Manufacturing. After the election of officers and the selection of the next place of meeting, the convention adjourned. The following officers were elected for the coming year: President, E. M. Woodward; First Vice-President, William Lodge; Second Vice-President, William P. Davis; Secretary, P. E. Montanus; Treasurer, F. E. Reed. The next meeting of the association will be held at Atlantic City.

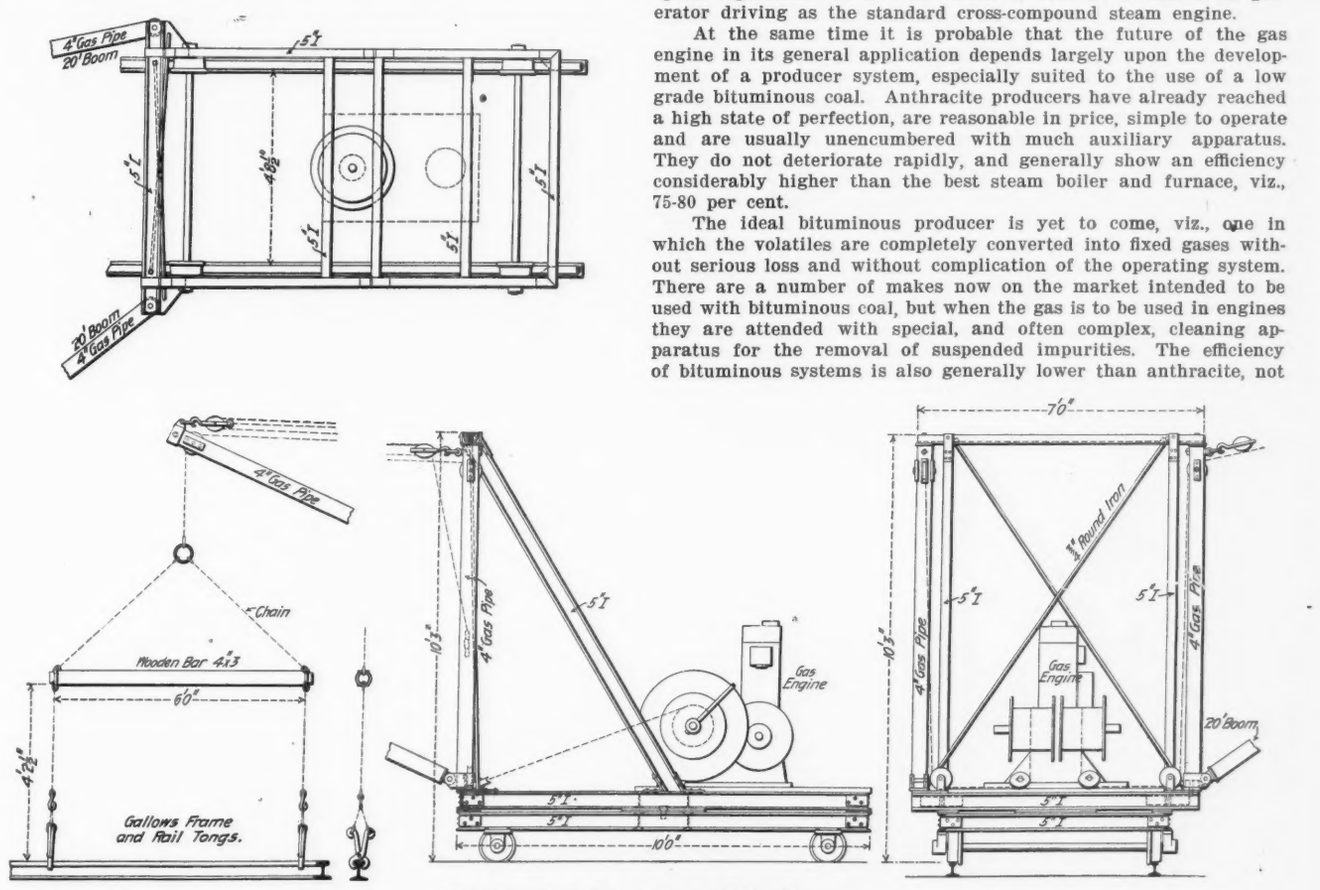
The Y. M. C. A. at Detroit.

The National Convention of Railroad Young Men's Christian Associations, held at Detroit, September 28-October 1, was attended by 1,437 delegates, representing 212 associations, including some in Mexico, British Columbia and Nova Scotia. On Sunday evening 51 meetings were held, mostly in churches, and the aggregate attendance was 12,000. About 1,300 men took part in these 51 meetings. At one midday meeting the workmen in a large number of shops and factories were invited, and about 9,000 attended. Religious activity has been so stimulated in Detroit that it is said meetings will be continued in the shops and factories.

One of the speakers at the conference was President George W. Stevens, of the Chesapeake & Ohio, who said: "We carry 3,500,000 passengers and 43,000,000 tons of freight a year, and last year lost but two employees and not one passenger's life. I give large credit for this condition to the influence of the Young Men's Christian Association." Other speakers were General Manager Garrett, of the Queen & Crescent; Hon. Leslie M. Shaw, Secretary of the Treasury, and Miss Helen M. Gould. Miss Gould's latest gift to the Y. M. C. A. is the sum of $150,000 for a building for the railroad association in St. Louis. The 212 associations represented now have a membership of 74,000 and a daily attendance of 34,000; students in educational classes, 2,664; in Bible classes, 4,183. One short road contributed $30,000 last year for the maintenance of associations.

The Travis Rail Loader and Unloader.

The accompanying illustrations show an effective device designed by O. J. Travis, Superintendent Bridges and Buildings, of the Colorado & Southern, for loading and unloading rails on and off of cars. The machine as shown is equipped with a turntable center so that the boom can be swung completely around, enabling it to unload rails from either end of the car. The device is carried over the road on an ordinary flat car and is especially useful for unloading rails from coal cars, in which case trestles or horses are placed in the coal cars. Skids are then used to run the loader from the flat car to the trestles, which must be of sufficient height to allow the unloader to clear the closed end of the coal car. By placing the loader on the trestles in the car, rails are just as readily loaded and unloaded from coal cars as they are from flat cars. The movement of the two booms is independent of each other and the rails can be picked up and unloaded on both sides of the track at the same time. It is claimed that this machine will do more work in a given time with six men than can be accomplished in the ordinary way with the average unloading gang of 40 men, and do it in a better and safer manner. Being mounted on standard gage trucks, this machine can also be used at wrecks for picking up coal, coke, grain, timber, etc. It can also be used to load coal in storage yards. If desired, it can readily be transferred to narrow gage trucks, and it is not confined to short lifts, as it can reach the load no matter where located, providing that it is within a reasonable distance.



The Travis Rail Loader and Unloader.

Friedrich List.

Recently a monument to Friedrich List was unveiled near Stuttgart, in memory of his labors for the establishment of a German railroad system. List was not always so honored there; for he came to America under sentence of banishment, after a term in prison. He lived for some time in the Pennsylvania anthracite regions and was interested in the Tamaqua & Port Clinton Railroad, opened in 1831, one of the earliest railroad projects there, and when he returned to Germany he gave his life chiefly to advocating railroad-building there. Under President Jackson he was for a time United States Consul in Leipsic, and he was the most active promoter of what became the Leipsic & Dresden Railroad. He also planned railroads in France, Belgium and elsewhere, but became so disheartened that he committed suicide in 1846. List is also noted as an advocate of a protection tariff in his "National System of Political Economy," the seventh edition of which was issued in 1877. He for a time edited a "Railroad Journal" in Germany.

Application of Gas Power to Electric Railway Service.

In a paper read before the American Street Railway Association at its recent convention in Philadelphia, Mr. J. R. Bibbins presented an argument in favor of the gas engine as a motor for electric railway plants.

He maintained that the uniformity of turning moment and speed regulation are as well suited to both D. C. and A. E. generator driving as the standard cross-compound steam engine.

At the same time it is probable that the future of the gas engine in its general application depends largely upon the development of a producer system, especially suited to the use of a low grade bituminous coal. Anthracite producers have already reached a high state of perfection, are reasonable in price, simple to operate and are usually unencumbered with much auxiliary apparatus. They do not deteriorate rapidly, and generally show an efficiency considerably higher than the best steam boiler and furnace, viz., 75-80 per cent.

The ideal bituminous producer is yet to come, viz., one in which the volatiles are completely converted into fixed gases without serious loss and without complication of the operating system. There are a number of makes now on the market intended to be used with bituminous coal, but when the gas is to be used in engines they are attended with special, and often complex, cleaning apparatus for the removal of suspended impurities. The efficiency of bituminous systems is also generally lower than anthracite, not only owing to the fact that some of the valuable distillates are lost, but on account of the distillation of volatile matter requiring heat for its accomplishment. Present types, however, sometimes exceed 70 per cent. efficiency, which rivals that of the best boiler plant.

In actual running, fuel consumption, gas power presents its most striking advantage over steam. It is difficult to obtain statistics truly comparative in every respect. Some data, trustworthy in the aggregate, are available from the tests conducted during the past year at St. Louis by the United States Government.

The most remarkable result is that the poorest grade coals and even lignites are entirely suitable for producer work. Thus, Montana, North Dakota and Texas lignites, averaging only 8,242 B.t.u. per pound (11,400 dry) yielded a gas of 169 B.t.u. per cubic foot, a gross producer efficiency of 66 per cent., and a duty of 2.5 lbs. per k.w.h. dry, or 3.6 lbs. per k.w.h. as fired. The best coals (West Virginia) gave an actual duty of 1.57 lbs. per k.w.h., and the poorest 3¼ to 4½ lbs. as fired. The average of the 17 tests showed a plant duty of 2.2 lbs. per k.w.h. dry, or 2.5 lbs. as fired.

Taking a common heat value for average bituminous coal 13,000 B.t.u. per pound, we observe that the plant duty is less than 2 lbs. per k.w.h. with gas and 5½ lbs. with steam.

Passing to some of the practical points, a producer, if provided with an automatic blast control, may be made almost instantly responsive to variations in demand for gas.

Although producers have been designed and successfully operated without a gas holder, the especially severe condition of heavy railroad work prescribes storage capacity at some part of the system, and electric storage is evidently the most desirable, as it relieves the machinery of the wear and tear of fluctuating loads.

In the matter of labor it is maintained that the cost in a

steam plant should be greater than in a gas plant of the same grade, though figures are not available by which it can be definitely proven. In oil consumption two 500 k.w. gas plants at Franklin and Bradford, Pa. (each consisting of five Westinghouse vertical enclosed type engine units), average through the year less than half a gallon per unit day, at a total cost of under seven cents (.0032 gallons per h.p. day).

Maintenance expense is frequently thought to be excessive in a gas station. When this is so we may look for faulty operation or design of the plant. Recent data from the station at Bradford, Pa., shows what may be accomplished when the equipment is *properly operated.* The plant is in its seventh year of service; yet the average cost of repairs on the engines for the last two years was $92.70 per year, 11.6 cents per h.p. year, or .0125 cents per k.w.h. generated.

The present exhaust valves average one year's working without regrinding, and even then are not in bad condition. Some valves have run 15 months. Admission valves require no attention. Igniters average about nine months without repointing. By reversing the current each day electro deposition is entirely avoided, so that the points wear evenly.

Comparative plant economy is best brought out in figures expressing the total operating cost of power.

In one case with a load factor of only 15½ per cent. and coal at $6.75 per ton, delivered, the total cost of generating current was 1.7 cents per k.w.h.; or, based upon current delivered to consumer, 2.13 cents per k.w.h., the average price obtained being 7.14 cents, and the net profit 9 per cent.

This same plant required throughout the year's run but slightly over two pounds of coal per k.w.h. generated.

At the Bradford, Pa., station (see table 5, appendix 4), although handicapped with old type belted machinery, the average yearly gas consumption is less than 25 cu. ft. of gas per k.w.h. on a 19½ per cent. load factor, and a total operating cost of power of about 0.8 cents per k.w.h.

The station at Franklin, Pa., operating on natural gas of exceptionally high calorific value, gives experience of similar character. The engines regularly operate 30 hours to a run. With a load factor of 15 per cent. to 20 per cent., as low as 17 cu. ft. of gas per k.w.h. was recorded for the year 1904, at a total operating cost of under one cent per k.w.h. In the cases of both the Bradford and Franklin plants building heating by natural gas is included in the gas charge for the engines.

The application of the gas engine to railroad service has in this country been limited; yet we find abroad many evidences of successful working. A prominent European engineer reported in 1903: "Nineteen stations on tramway work, totaling 6,000 h.p. capacity. These include Barcelona, Tunis, Lausanne, St. Gallen, Poictiers, Orleans and Zurich, from 400 to 600 h.p., each working on either producer or town gas." As a result of the excellent experience with the Walthamstow electricity station, 650 h.p. has been added to the plant for operating the new tramway system recently constructed. At Buenos Ayres, South America, two plants, aggregating 2,240 h.p., are at work for the Buenos Ayres Great Western and Great Southern Railways. Both use Mond gas.

But, eclipsing in interest probably all former gas power railroad undertakings is that of the Warren and Jamestown Railway system now under construction. This plant will practically inaugurate the use of the heavy duty type engine, in connection with single phase railroad systems in America.

The new engine equipment, now nearing completion, consists of two 500 h.p. Westinghouse double acting engines of the horizontal tandem type, each direct connected to a 260 k.w. A. C. engine type generator. These engines are both of the single crank type, but with the tandem arrangement a power stroke is developed at each half revolution, as in the double acting steam engine. The gas units will operate in parallel on the electrical end, without the necessity of synchronizing the cranks.

Natural gas fuel is entirely used in this territory, and at the present price and heat value will correspond with producer gas delivered at a cost of about two cents per thousand cubic feet. The economy in operating with natural gas is striking. In the old gas plant it is estimated that the cost of power averages .75 cents per k.w.h., including all items chargeable to operation, except repairs on building and battery; the corresponding gas consumption being 20 cu. ft. per k.w.h.

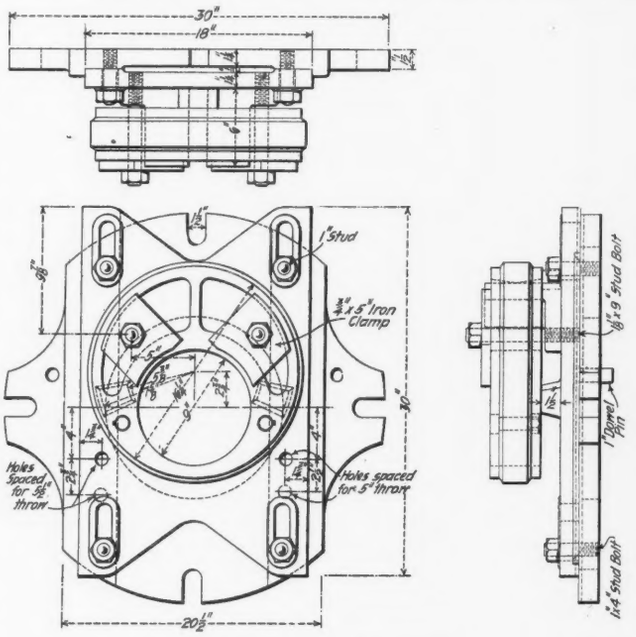
Among gas power stations in American and British territory we find a large number up to 2,600 h.p. capacity operating on producer, natural and oil gas, and many with the A. C. system with generators, running in electrical parallel.

The utilization of waste products of manufacture has within recent years made great progress. Gaseous by-products have already been put to use on a large scale, but the near future may readily witness the use of the producer in its present or in modified form for utilizing all combustible wastes recoverable in manufacturing processes. Blast furnace gas applications are now more or less familiar; coke oven gas from by-product coke ovens has many notable applications in Europe (a small plant is in use at Camden, N. J.); and oil gas (obtained by fractional distillation of petroleum—a by-product in the refining process) has lately been successfully applied in America.

The conclusions to be derived from a careful consideration of the subject are: That the gas engine has been brought to a state of development where it is capable of doing the same work as the steam engine, with far greater efficiency, and usually at reduced cost; that the producer has been so far perfected as to be a reliable and more efficient generator than the steam boiler; that the gas power plant "in toto" is entirely suitable for even the severe service incident to electric railway operation; that its component parts, engine and producer are possessed of characteristics leading to harmonious co-operation; that practical difficulties incident to gas power working have been so far overcome as to warrant commercial confidence; and that experience with gas power in almost every known line of modern industry has proven its general sufficiency for any power service.

Chuck for Holding Eccentrics.

The accompanying illustration shows a chuck for holding eccentrics, designed by Ben Johnson, Superintendent of Machinery, Aguascalientes shops of the Mexican Central Railroad. It consists of a body which is bolted to the face-plate of the lathe, its location on the face-plate being determined by two dowel pins which fit into holes in the face-plate. Sliding on this body and secured to it by four studs is a piece to which the eccentric is



Chuck for Holding Eccentrics.

fastened by means of two studs and clamps as shown. The proper location of the eccentric on this piece is determined by the two lugs which are shown, cast on the sliding piece.

When the eccentric is bolted on to the chuck in the position shown, the axle fit is bored, and then by loosening the nuts on the four studs, the sliding piece carrying with it the eccentric, is moved over an amount equal to the radial throw of the eccentric. It is then bolted in position by inserting the taper dowel pin in another hole and tightening up the nuts on the four studs in the slides. The outside of the eccentric is then turned. In this way the boring and turning are both done at one setting of the eccentric and a considerable economy is effected.

Complaints having been made that when there is a pressure of traffic at Russian stations, as there always is after harvest, no shipper stands any chance of having his freight forwarded unless he fees the railroad employees, some one cites the pay of employees as likely to induce such practices. Men temporarily engaged in the general offices get on the average $122 a year; permanent employees $466 (these including officers with the highest salaries). In the maintenance of way department the average pay is $105 a year; in train service $152. It is said that such pay is not enough for a family to live on. But the fact is that most of those in the lowest positions, whose pay is less than these averages, rarely if ever have a chance to extort money from the patrons of the railroads; and that according to popular belief, in other government service if not in railroad service, men in quite important positions have to be "seen" before they will do their duty.

GENERAL NEWS SECTION

NOTES.

The Chicago, Rock Island & Pacific has discontinued all of its "interurban" passenger trains in Iowa.

To increase its supply of small sizes of coal the Reading has put five anthracite washeries in operation. The demand for small sizes is unusually great.

The Pennsylvania is being prosecuted in the United States Court in Ohio for running a freight car between Columbus and Pittsburg not equipped with automatic couplers.

It is announced in Montreal that the Canadian Pacific has made reductions on all freight rates to the Pacific coast, the new basis being 49 cents (first class) per 100 lbs. less than the tariff hitherto in force.

Chicago papers say that the Atchison, Topeka & Santa Fe proposes to spend $400,000 a year for the next five years in promoting the settlement of the states and territories on the southwestern part of its lines.

Mr. E. H. Harriman is having an examination made of the routes over which it is proposed to build railroads in the Philippine Islands. Mr. Robert Hawxhurst, Jr., formerly Chief Engineer of the Kohola & Hilo (Hawaii), is in charge of the work.

A despatch from Kansas City indicates that the railroads of Missouri have been successful in postponing the enforcement of the maximum freight rate law. The Attorney General has withdrawn his demurrer and this action is expected to lead to indefinite delay in the enforcement of the law.

The Lake Shore & Michigan Southern has put new padlocks (with keys different from the old ones) on all switches throughout the company's lines. It is said that the officers believe that the misplacement of the switch at Mentor recently, which caused a disastrous derailment, is chargeable to some person, not an employee, who had a switch key. Records have been made of the names of all persons to whom the new keys have been issued.

A number of railroads in Vermont are protesting against an order made by the Railroad Commission of that state requiring the use of certain signals at crossings where the railroad is crossed by an electric railway. The signal is a disk, fixed some distance from the crossing, to be set against approaching trains by the conductor of the electric car. The railroads claim that the disks prescribed are not large enough and that the signals, as ordered to be arranged, are more dangerous than not to have any signals at all.

Members of the New York Produce Exchange who have for some time been complaining of an unusual scarcity of cars at Buffalo for the shipment of export grain to Boston and New York, announce that the railroads have promised to concentrate all available cars at Buffalo and to "allow the general movement of merchandise to suffer." The congestion of grain at Buffalo, grain brought there by lake vessels, is so great that the railroads are now making contracts with shippers for the carriage of their grain only subject to delay, and also subject to additional storage charges at Buffalo.

The southbound trains of the Interborough Rapid Transit Company on the Ninth avenue elevated line, New York City, now pass the Fifty-third street junction without stopping. It is said that this disregard of the order issued by the state Railroad Commission, after the recent disastrous derailment at that point, is justified by the road on the ground that the stops cause congestion of traffic and so delay the passengers. This action appears to have been taken with the knowledge of the commission, and apparently with its consent.

Conductor W. B. Caldwell, who was indicted by the Grand Jury of Jefferson County, Tennessee, on a charge of involuntary manslaughter, or criminal negligence resulting in the terrible butting collision of passenger trains at New Market, Tenn., Sept. 24, 1904, killing over 60 persons, was tried last week, and the result was a mistrial, the jury failing to agree. It is said that the case will be again tried at the next term of the court. The principal witness for the prosecution was a law agent of the Southern Railway, who testified that the conductor had told him a few minutes after the wreck that it was caused by his forgetting orders to meet a train a few miles back.

A Real Airship.

An invention which will solve the problem of transportation in rural communities, where, by reason of physical obstacles, steam and electric lines cannot well be used, is now being perfected by B. W. Harris, of Waveland, Ind. In brief, the invention includes an overhead system of cables not only furnishing support but also carrying the current of electricity for power. The car thus operated can be used for freight or passengers. The experimental car that Mr. Harris has constructed at Mattoon, where he is now working, will hold five people. The cables supporting the car are in turn supported by poles. Uneven breaks in the ground, little hills and valleys, have no effect on the level plain of the cable, as the poles are cut to a length that keeps the cables level. The long aerial car is of aluminum, coming to a sharp point at both ends to do away with as much resistance as possible. At each side there is a small door, by which the operator enters. The propelling power—electricity—is collected by the glass wheels upon which the car glides from the cables which form the track. The four wheels, which are about 14 inches in diameter, are deeply grooved, thus making it impossible for the car to leave the cables. The operator can control the car at all times from within, having levers and switches by which he can reverse, start or stop the car instantly.—*Indianapolis News.*

General Electric Company's Awards at Portland.

The Jury of Awards of the Lewis and Clark Exposition at Portland, Ore., has awarded gold medals to the General Electric Company for the following features of its exhibit in the electrical department: For the best exhibit in the electrical department, Curtis steam turbine, meters and instruments, time-limit relays and oil switches, switchboards, meter controlling panels, circuit breakers and lightning arresters; direct and alternating current motors, direct and alternating current generators, static transformers, automatic voltage regulators, magnetite arc lamp, alternating and direct current enclosed arc lamps, mercury arc lamps, magnetic starting device for mercury arc lamps, mercury arc rectifier, railway motors and controllers, mining locomotives, searchlight and method of control, progress and development in the electrical art, metalized carbon filament incandescent lamps. The gold medals were the highest awards. Not only was the exhibit of the General Electric Company the largest and most complete of any of the electrical manufacturers on the grounds but the Exposition was lighted throughout with Edison incandescent lamps made by this company. The new "meridian" lamps, also made by the General Electric Company, were extensively used.

Lectures on Traffic at N. Y. University.

The School of Commerce of New York University is to have three courses in "railway traffic," to be conducted on Monday evenings during the current year by W. H. Lough, Jr. The announcement says that these courses are of a thoroughly practical character, designed to be directly beneficial to men employed in traffic offices. . . . "They are the beginning of an attempt on the part of the School of Commerce to put the study of railroad methods on a scientific basis, and to prepare young men for responsible positions in the railroad service more thoroughly and more quickly than can now be done." Classes in railroad organization, railroad law and railroad accounts are proposed also. Eventually the school expects to offer to railroad men a well rounded series of courses in their profession. Professor J. F. Johnson, Dean of the School, says: "We cannot provide brains, and a good deal of the detailed training must be picked up in day-to-day work, but we can give our young men an intelligent outlook over the railroad field. . . ."

Good Roads Propaganda in Iowa.

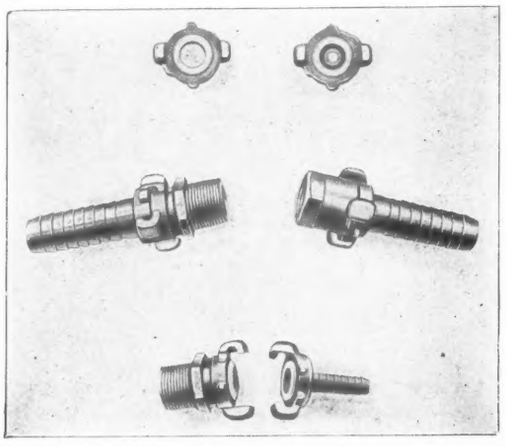
It is announced that a party of speakers and expert road builders are to be carried in special trains over the lines of the Chicago, Burlington & Quincy during the last ten days of October and over the Chicago Great Western in the first part of November. The purpose of the trip is to arouse interest in good roads and spread information concerning the best methods in road-building.

The Chicago Hose Coupler.

This universal coupler was designed for a standard, to avoid extra expense for specially constructed couplers to suit various sizes of hose used with pneumatic tools. It has no male or female part at the coupling end, but instead each half has both male and female features, so that each half is exactly the same and will couple regardless of the size and style of the shank, making it a universal coupler in every sense of the word. Quarter-inch hose

will couple with three-quarter-inch hose, one-inch pipe, or anything having one of the Chicago couplers attached to it.

The shanks are manufactured for pipe male thread, pipe female thread, and hose in standard commercial sizes one-quarter inch up



The Chicago Hose Coupler.

to one inch, which enables all couplings to be made without resorting to reducers or special shanks to meet the conditions presenting themselves where pneumatic tools are in use.

These couplers are manufactured by the Chicago Pneumatic Tool Company, who have manufacturing facilities for 500 sets per day.

Manufacturing and Business.

The Electro-Dynamic Company, of New York and Bayonne, N. J., has moved its St. Louis office to Seventh and Hickory streets.

B. V. H. Johnson, General Agent of the Safety Car Heating & Lighting Co., at St. Louis, has been transferred to the Philadelphia office, and Charles B. Adams has been appointed as General Agent at St. Louis.

Mr. George William Catt, President of the Atlantic, Gulf & Pacific Co., died in New York City on October 8, at the age of 45. He took a C. E. degree from the Iowa State College in 1882, and then went into the offices of the King Bridge Co., of Cleveland, being Bridge and Contracting Engineer in the Mississippi valley several years. In 1885, he went to the Pacific coast in charge of that company's business in that region, and the next year became Chief Engineer of the San Francisco Bridge Co. In 1889, he was placed in charge of the Seattle office of that company, and in the next two years did much of the bridge work on the Great Northern and other railroads which were built at that time in the state of Washington. In 1891, Mr. Catt went to Boston and obtained a contract for some hydraulic dredging in Boston harbor. He developed this business on the Atlantic coast and in the next year organized the New York Dredging Co. In 1899, the business of this company was merged into the new corporation, the Atlantic, Gulf & Pacific Co., Mr. Catt being the President and Chief Engineer until his death. He was also Consulting Engineer and Vice-President of the Puget Sound Bridge & Dredging Co., of Seattle, and Consulting Engineer of the San Francisco Bridge Co. and the British Columbia General Contract Co. We quote the following appreciation of Mr. Catt by Mr. Henry S. Wood, Secretary and Treasurer of the Atlantic, Gulf & Pacific Co.: "Notwithstanding the most successful business career of Mr. Catt, his greatest contribution to society has been the demonstration of an upright and firm but generous character. Of exemplary personal habits, he demanded of his assistants and recommended by his example to his associates a life free from reproach, efficient in service and loyal to the interests over which he exercised such able control. Whether in college fraternity or the leading engineering societies of the United States, his associates will remember him with pleasure, and his taking off with the deepest regret. The engineer's profession of America is poorer by his loss."

G. W. Catt.

The O. M. Edwards Company, Syracuse, New York, announce that it has recently appointed W. G. Willcoxson as its Chicago representative, and that Mr. E. F. Chaffee, formerly Passenger Car Foreman, at the West Albany shops of the N. Y. C. & H. R. R. R., has been appointed as its Eastern representative, with headquarters in New York City.

T. K. Wells has been appointed Superintendent of Transportation of the Manila Electric Railway and Lighting Company, of Manila P. I. Mr. Wells has had a wide experience in railroad work having been with the Wabash Railroad and the St. Louis, Iron Mountain & Southern Railroad for 14 years and with the Syracuse Rapid Transit Company for eight years.

The Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, has recently received a large order for hollow staybolt bars from the American Railroad Company, San Juan, Porto Rico, and also a large additional order for shipment to Japan. Mr. F. C. Lippert has taken a position with this company as traveling salesman in the western territory with headquarters at St. Louis, Mo.

It is announced that the Pratt & Whitney Company have purchased a plant in Dundas, Ontario, for the manufacture of its full line of small tools—such as taps, reamers, milling cutters, punches, dies, twist drills, etc. The building is a modern structure, and the power plant is already in place. The location of the factory is near that of the John Bertram & Sons' Company, which, as has been announced, was recently purchased by the Niles-Bement-Pond Company.

The American Blower Company reports all departments of its shops at Detroit to be extremely busy. Among other large orders under way is one for the complete heating apparatus for the new Allegheny shops of the Pennsylvania Lines West of Pittsburg. Orders from the wood-working field include a fifth dry kiln for the W. F. Stewart Co., Flint, Mich. and kilns for the English Mfg. Co., Morrill, Wis.; I. B. Morrison, Hallville, Tex., and the Buffalo (N. Y.) Lounge Co.

The Abner Doble Company, San Francisco, has recently received an order from the California Gas & Electric Corporation for a 9,000-h. p. Doble tangential water wheel for its De Sabla power plant. This machine will be similar to the 8,000-h. p. Doble wheel installed in the De Sabla plant last year and the three 8,000-h. p. Doble wheels recently completed and now successfully operating in the new electra station of the same company. The wheel will operate under a head of 1,530 ft., at 400 r. p. m., and will be driven by a single jet of water, thus making it the most powerful water wheel ever constructed for operation under a single jet of water.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Association of Railroad Surgeons.

This association, a consolidation of the International Association and the American Academy, held its first regular meeting at Chicago, October 11. The President for the ensuing year is Dr. R. W. Corwin, Pueblo, Colo., Chief Surgeon of the Colorado Fuel & Iron Co.; Secretary, Dr. H. B. Jennings (C., R. I. & P.), Council Bluffs, Iowa.

Transportation and Car Accounting Officers.

Secretary G. P. Conard announces that the November meeting of the Association of Transportation and Car Accounting Officers will be held at the Jefferson Hotel, St. Louis, Mo. (not New Orleans), on Tuesday, November 21. There will be reports from the Committees on Conducting Transportation; on Car Service; on Office Methods; on Per Diem, and on Handling Railroad Service Mail.

PERSONAL.

—Mr. W. G. Edmundson, who has been appointed Engineer of Tests of the Philadelphia & Reading, is a graduate of Cornell University. He worked in the shops of the Brooks Locomotive Works and of the Pittsburg & Lake Erie Railroad at Pittsburg for about two years. In 1902, he went to the Pennsylvania Railroad as draftsman, becoming later an inspector of buildings in the shops and power plants.

—Mr. Hal. S. Ray, who was recently appointed Assistant General Passenger Agent of the Rock Island System, was born in Connecticut in 1869. He was educated at the Philadelphia Central High School and entered railroad service as a clerk in the district pas-

senger office of the Chicago, Rock Island & Pacific at Philadelphia in 1890. All of his work has been done for this company. He has served successively as Assistant City Passenger and Ticket Agent at Des Moines, Iowa; City Passenger and Ticket Agent at Wichita, Kan.; District Passenger Agent at Wichita; Traveling Passenger Agent at Pittsburg, Pa.; District Passenger Agent at Philadelphia; General Agent of the Passenger Department at Denver, and General Eastern Passenger Agent in New York for both the Rock Island and the Frisco Systems, from which position he was recently promoted.

—The election of Mr. F. A. Delano to the Presidency of the Wabash Railroad was announced in the *Railroad Gazette* last week. His career is too well-known to our readers to need extended mention, but the accompanying portrait may be new to some of them. Mr. Delano began his railroad service on the Chicago, Burlington & Quincy in 1885. He was steadily promoted and in 1901 was elected Vice-President and General Manager of the Lines East of the Missouri River. In 1904 he resigned and was out of railroad service until April of this year, when he went to the Wabash as Vice-President. He is also President of the other Wabash properties, the Wheeling & Lake Erie, the Wabash-Pittsburg Terminal and the West Side Belt.

F. A. Delano.

—Mr. G. B. Obey, who was recently appointed Superintendent of the Monongahela Railroad, entered railroad service a little over 20 years ago as telegraph operator on the Baltimore & Ohio. Later he went to the Pittsburg & Lake Erie and served there successively as despatcher, chief despatcher, and since 1901, Superintendent of the Monongahela & Youghiogheny division, from which office he was transferred to his new position.

—The accompanying photograph of Mr. A. B. Stickney, President of the Chicago Great Western, is of interest at this time on account of the interest aroused in Mr. Stickney's testimony before the Federal Court at Chicago. Mr. Stickney said: "In fixing the rate on dressed meat we do not have very much to say. The packer generally makes the rate. He comes to you and always makes you feel that he is your friend. Then he asks you how much you charge for certain shipments of dressed meats. The published tariff may be 23 cents a hundred, but he will not pay you that. You say to him, 'I'll carry your meat for 18 cents.' He says, 'Oh, no, you won't. I won't pay that.' Then you say, 'Well, what will you pay for it?' He then replies, 'I can get it hauled for 16 cents.' So you haul it for 16 cents a hundred. He generally tells you that if you want the business you must haul the meat for the price he names."

A. B. Stickney.

ELECTIONS AND APPOINTMENTS.

Arkansas Southern.—A. R. Porterfield, Auditor, has resigned, and the office has been abolished. The authority of the officials of the Accounting department of the Chicago, Rock Island & Pacific has been extended over that department of the Arkansas Southern.

Atchison, Topeka & Santa Fe.—W. J. Black, General Passenger Agent of the A., T. & S. F., has been appointed Passenger Traffic Manager of the whole system, succeeding George T. Nicholson, promoted. James M. Connell, General Agent of the Passenger department, at Chicago, succeeds Mr. Black. E. J. Shakeshaft, Chief Clerk in the general passenger office at Topeka, has been appointed Assistant General Passenger Agent.

Atchison, Topeka & Santa Fe (Coast Lines).—J. J. Byrne, General Passenger Agent, has been appointed Assistant Passenger Traffic Manager, with office at Los Angeles, Cal.

Buffalo & Susquehanna.—The offices of F. H. Goodyear, President, and C. W. Goodyear, Vice-President, are at Buffalo, N. Y., not at Baltimore, Md., as reported.

Chicago, Milwaukee & St. Paul.—Until further notice, the duties of General Manager will be performed by W. J. Underwood, Assistant General Manager.

Chicago, Rock Island & Pacific.—W. H. Burns, Auditor of Freight Traffic, has been appointed to the newly created office of Assistant to the General Auditor. C. G. Weaver, Assistant Auditor of Freight Traffic, succeeds Mr. Burns. L. K. Luff succeeds Mr. Weaver.

Colorado & Southern.—A. D. Parker, General Auditor, has been elected Vice-President, in charge of the Accounting department.

Detroit River Tunnel.—J. C. Mock, Signal Engineer of the Michigan Central, has been appointed Electrical Engineer of the D. R. T.

Detroit, Toledo & Ironton.—J. C. Homer, Superintendent of Motive Power, has resigned. W. J. Haynen, hitherto Division Master Mechanic at De Soto, Mo., succeeds Mr. Homer.

Erie.—W. H. Hamilton has been elected a director, succeeding Robert Bacon. Russell Harding, heretofore First Vice-President of the Cincinnati, Hamilton & Dayton, the Pere Marquette and the Chicago, Cincinnati & Louisville, has been elected Vice-President of the entire Erie system, in charge of operation. His headquarters will be at New York.

G. A. Heller, Superintendent of the Delaware division, has resigned. W. C. Hayes, hitherto Superintendent of the Employment Bureau, at Jersey City, succeeds Mr. Heller, with office at Susquehanna, Pa.

Grand Trunk Pacific.—A. B. Smith has been appointed Manager of the Telegraph Department, with office at Montreal, effective November 1.

Gulf, Colorado & Santa Fe.—J. H. Keefe has been appointed Assistant to the Second Vice-President and General Manager.

Iowa Central.—Marquis Barr, Claim Agent at Oskaloosa, Iowa, has been appointed General Claim Agent of the Iowa Central and the Minneapolis & St. Louis, with office at Minneapolis.

Little Rock & Southern.—The newly elected officers of this road, which is being constructed by the Rock Island, are as follows: E. B. Pierce, President and Treasurer; W. S. Tinsman, Vice-President; T. S. Buzbee, Secretary, and G. H. Crosby, Assistant Secretary and Treasurer.

Louisville & Nashville.—C. H. Cannon has been appointed Signal Engineer, with headquarters at Louisville.

Mexican Central.—J. G. Smith has been appointed Master Mechanic of the Coahuila & Pacific division, with office at Saltillo, Coahuila.

Michigan Central.—E. A. Everett has been appointed acting Signal Engineer; office at Detroit. See Detroit River Tunnel.

Missouri, Kansas & Texas.—George Morton, General Passenger and Ticket Agent, has resigned. W. S. St. George, General Eastern Agent, succeeds Mr. Morton.

Minneapolis & St. Louis.—See Iowa Central.

New York, Chicago & St. Louis.—C. B. Gorham, Superintendent of the Eastern division, has resigned. W. L. Blair, Superintendent of Telegraph, succeeds Mr. Gorham. R. W. Mitchener, Trainmaster at Conneaut, Ohio, succeeds Mr. Blair.

New York, New Haven & Hartford.—C. M. Ingersoll, Chief Engineer, has been appointed Commissioner in charge of the new department of real estate, right of way and taxes. He will be assisted by a Real Estate Agent, Engineer, Rent Agent, and other assistants whom he may appoint from time to time with the approval of the President. He reports direct to the President.

Edward Gagel, Principal Assistant Engineer, succeeds Mr. Ingersoll as Chief Engineer, with headquarters at New Haven.

South & Western.—John A. Muse, General Freight and Passenger Agent, has been appointed Assistant Auditor. Lewis Walke has been appointed General Freight and Passenger Agent, succeeding Mr. Muse, with office at Bristol, Va.

Spokane Falls & Northern.—E. S. Blair, General Agent of the Great Northern, at San Francisco, has been appointed General Freight and Passenger Agent of the S. F. & N., with office at Spokane, Wash., succeeding H. A. Jackson, resigned.

Tidewater.—R. C. Johnson has been appointed Division Engineer, in charge of signals, with office at Norfolk, Va.

Union Pacific.—P. A. Valentine has been elected a director in place of James H. Hyde.

Wabash.—C. B. Adams, Superintendent of Transportation, has resigned. D. I. Forsyth, Assistant Superintendent of Transportation, has been appointed Acting Superintendent of Transportation.

Wisconsin Central.—Newman Erb and George M. Cumming have been elected directors, succeeding J. S. Dale and F. R. Hart.

LOCOMOTIVE BUILDING.

The Chesapeake & Ohio is reported as figuring on about 35 locomotives.

The Durham & Southern has ordered two locomotives from the Baldwin Works.

The Chicago, Burlington & Quincy, it is reported, has ordered 50 locomotives from the Baldwin Works.

The Western Maryland has ordered a 150-ton Shay locomotive from the Lima Locomotive & Machine Co.

The Boston & Maine has ordered 10 locomotives from the American Locomotive Co. These will be made at the Manchester Works.

The Durham & Southern has ordered two 18-in. x 26-in. 10-wheel locomotives from the Baldwin Works for November delivery.

The Chesapeake & Ohio has ordered one Shay locomotive from the Lima Locomotive & Machine Co. The total weight of this engine will be 150 tons.

The Canadian Pacific, it is reported, has just placed an order with the American Locomotive Co. for 35 ten-wheel Canadian Pacific class "700" passenger locomotives.

The St. Louis, Brownsville & Mexico, as reported in our issue of October 13, has ordered nine locomotives from the Baldwin Works, including four 10-wheel freight engines, two switching engines and three eight-wheel passenger engines.

The Baltimore & Ohio has ordered 245 locomotives from the American Locomotive Co. This order includes both freight and passenger engines. The freight engines are of the 2-8-0 type and the passenger engines are of the 4-6-2 type.

The Chicago & North-Western has ordered 70 locomotives from the American Locomotive Co., as follows: Twenty-five 18 in. x 24 in. 6-wheel switching engines, 10 Atlantic type passenger engines, and 35 21-in. x 26-in. 10-wheel freight engines. All of the above are duplicates of previous orders.

The Chicago, Burlington & Quincy has ordered 50 simple Prairie type locomotives from the Baldwin Co. The locomotives weigh 205,000 lbs., with 150,000 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 69 in.; radial stay boiler; working steam pressure, 210 lbs.; heating surface, 3,584 sq. ft.; 301 tubes, 2¼ in. in diameter and 19 ft. long; firebox, 108 in. x 72 in.; grate area, 54 sq. ft.; tender capacity, 8,000 gallons of water and 16 tons of coal.

The Central of New Jersey has ordered 10 simple consolidation type locomotives from the American Locomotive Co. These engines will weigh 210,000 lbs., with 186,000 lbs. on drivers; cylinders, 20 in. x 32 in.; diameter of drivers, 61 in.; wagon top boiler, with a working steam pressure of 200 lbs.; total heating surface, 3,259 sq. ft.; 409 tubes, 2 in. in diameter x 14 ft. 3⅜ in. long; firebox, 123 in. long x 97 in. wide; grate area, 81.56 sq. ft.; tank capacity, 7,000 gallons of water and 16 tons of coal.

The Panama has ordered 24 2-6-4 type and 120 2-6-0 type locomotives from the American Locomotive Co. These engines will be made at the Schenectady Works and are for use on the Panama Canal construction work. The 2-6-4 locomotives weigh 183,500 lbs., with 124,000 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 54 in.; straight boiler, with a working steam pressure of 180 lbs.; total heating surface, 1,372.7 sq. ft.; 222 charcoal iron tubes, 2 in. in diameter x 12 ft. long; narrow firebox, 90$^{3}/_{16}$ in. long x 41¾ in. wide; grate area, 26.2 sq. ft. The engines are fitted with side and rear tanks having a water capacity of 3,700 gallons and a coal capacity of five tons.

The Chesapeake & Ohio has ordered 35 simple consolidation locomotives from the American Locomotive Co. These locomotives weigh 186,500 lbs., with 166,000 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 56 in.; extended wagon top boiler; working steam pressure, 200 lbs.; heating surface, 3,230 sq. ft.; 370 National steel tubes, 2 in. in diameter and 14 ft. 7 in. long; firebox, 90 in. x 75 in.; grate area, 47 sq. ft.; tender capacity, 6,000 gallons of water and 10 tons of coal. The special equipment includes: Westinghouse air-brakes, Carnegie axles, Gollmar bell ringers, Monarch brake-beams, Perfecto brake-shoes, Tower and Climax couplers, Hancock injectors, Jerome piston and valve rod packings, Leach sanding devices, Nathan sight feed lubricators, and Latrobe driving and truck wheel tires.

The Midland Valley, as reported in our issue of September 8, has ordered four 4-6-0 class and one 2-8-0 class locomotive from the Baldwin Works. The 2-8-0 class engine will weigh 136,000 lbs., with 120,000 lbs. on drivers; cylinders, 20 in. x 24 in.; diameter of drivers, 50 in.; wagon top boiler, with 180 lbs. working steam pressure. The 4-6-0 class engines will weigh 120,000 lbs., with 90,000 lbs. on drivers; cylinders, 18 in. x 24 in.; diameter of driving whels, 55 in.; wagon top boiler, with a working steam pressure of 180 lbs. The tenders of both classes of engines will be of the "U" type and will have a coal capacity of 10 tons and a water capacity of 5,000 gallons. The special equipment includes: Carnegie steel firebox, Standard tires, Franklin boiler covering, Richardson valves, Hancock injectors, Tower couplers, Pyle-National headlights, Westinghouse brakes, Nathan lubricators, Houston sanding device, and Crosby safety valves, steam gages and whistles.

The Atchison, Topeka & Santa Fe, as reported in our issue of September 29, is making 10 six-wheel simple oil-burning switching engines in its Topeka shops. These engines will weigh 144,000 lbs., and will have cylinders 20 in. x 26 in.; diameter of driving wheels, 51 in.; wagon top boiler, with a working steam pressure of 180 lbs.; firebox, 102⅛ in. x 41¼ in.; 281 tubes, 2 in. in diameter x 11 ft. 10¾ in. long; heating surface, tubes, 1,750 sq. ft.; firebox, 177.9 sq. ft.; total, 1,928 sq. ft.; grate area, 29.3 sq. ft. The tender will be of the "U" type and will have a water capacity of 3,900 gallons and a fuel capacity of 2,000 gallons. The special equipment includes: Lukens steel for both boiler and firebox, standard tires, Railway Steel Spring Co.'s springs, magnesia boiler covering, piston valves, Ohio injectors, Tower couplers, Hewitt journal bearings, Adams & Westlake headlights, Westinghouse brakes, Kewanee brake-beams, Crane safety valves, Chicago lubricators, United States metallic packing, Crosby steam gages and whistles, Gollmar bell-ringers, Leach sanding device, Johnston blow-off valves, Congdon brake-shoes and Standard Steel Works driving wheel centers.

The Northern Pacific, as reported in our issue of Oct. 13, has ordered 30 simple Mikado type engines; 20 simple Pacific type engines; 20 simple Prairie type engines and 10 simple six-wheel switching locomotives from the American Locomotive Co. for 1906 delivery. The Mikado type engines will weigh 260,000 lbs. with 205,000 lbs. on drivers; cylinders, 24 in. x 30 in.; diameter of drivers, 63 in.; wagon top boiler; working steam pressure, 200 lbs.; heating surface, 4,250 sq. ft.; 375 tubes, 2 in. in diameter and 19 ft. 6 in. long; firebox, 97 in. x 66 in.; tender capacity, 10,000 gallons of water and 12 tons of coal. The Pacific type engines weigh 219,000 lbs. with 143,000 lbs. on drivers; cylinders, 22 in. x 26 in.; diameter of drivers, 69 in.; wagon top boiler; working steam pressure, 200 lbs.; heating surface, 3,550 sq. ft.; 347 tubes, 2 in. in diameter and 18 ft. 6 in. long; firebox, 97 in. x 66 in.; tender capacity, 7,000 gallons of water and 12 tons of coal. The Prairie type engines weigh 195,000 lbs. with 150,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 63 in.; wagon top boiler; working steam pressure, 200 lbs.; heating surface about 3,200 sq. ft.; 350 tubes, 2 in. in diameter and 17 ft. long; firebox, 96 in. x 63 in.; grate area, 42 sq. ft.; tender capacity, 6,000 gallons of water and 12 tons of coal. The switching engines weigh 150,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; wagon top boiler; working steam pressure, 180 lbs.; heating surface, 1,700 sq. ft.; 264 tubes, 2 in. in diameter by 11 ft. 2 in. long; firebox, 102 in. x 42 in.; grate area, 29 sq. ft.; tender capacity, 24,000 gallons of water and six tons of coal.

CAR BUILDING.

The Texas Southern is in the market for freight cars.

The Union Pacific, it is reported, will build additional motor cars.

The Atlantic Coast Line is figuring on additional freight equipment.

The Maine Central, it is reported, is figuring on passenger equipment.

The Great Northern is in the market for 300 ore cars of 100,000 lbs. capacity.

The Lehigh Valley, it is reported, is figuring on about 2,500 box and coal cars.

The Isthmian Canal Commission has ordered 800 flat cars from the American Car Co.

The Chesapeake & Ohio has ordered 22 cabooses from the American Car & Foundry Co.

The Seaboard Air Line has ordered 500 additional box cars from the Western Steel Car Co.

The St. Louis Southwestern, it is reported, will shortly be in the market for freight cars.

The Chicago, St. Paul, Minneapolis & Omaha has ordered 40 passenger cars from the Pullman Co.

The Philadelphia & Reading, it is reported, has ordered 80 passenger cars from Harlan & Hollingsworth.

The Philadelphia & Westchester (Electric), it is reported, is in the market for some steel passenger cars.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 1,000 box cars from the American Car & Foundry Co.

The New York, Ontario & Western, it is reported, has ordered 10 passenger cars from Harlan & Hollingsworth.

The Harriman Lines have ordered 60 chair cars, 16 baggage cars and 25 cabooses from the American Car & Foundry Company.

The Central of New Jersey has ordered 25 passenger cars and six combination passenger and baggage cars from Harlan & Hollingsworth.

The Northern Pacific is in the market for 500 gondola cars in addition to the 5,000 box cars mentioned in our issue of September 29.

The New York, New Haven & Hartford, it is reported, has ordered a number of interurban electric cars from the Wason Manufacturing Co.

The Durham & Southern has ordered two passenger cars and one combination mail, baggage and express car from the American Car & Foundry Co.

The Chesapeake & Ohio, it is reported, has ordered 500 hopper cars from the Standard Steel Car Co. and 500 gondola cars from the American Car Co.

The Central Vermont is figuring on 500 flat cars of 60,000 lbs. capacity, 100 flat cars of 80,000 lbs. capacity, and 100 gondola cars of 80,000 lbs. capacity.

The Buffalo & Susquehanna has ordered 500 gondola cars of 100,000 lbs. capacity from Barney & Smith, and is reported as being in the market for upwards of 200 coal cars.

The South Side Elevated, Chicago, has ordered 50 car bodies from the American Car & Foundry Co. These are in addition to those reported in our issue of September 22.

The Chicago, Milwaukee & St. Paul has ordered 25 passenger cars, 15 of which are to be made by Barney & Smith and the remaining 10 have been ordered from the Pullman Co.

The Brooklyn Rapid Transit Company is asking bids on 150 semi-convertible surface cars. The trucks for these cars have been ordered from the Baldwin Locomotive Works and the order for the wheels has been given to the Schoen Steel Wheel Co.

The Pennsylvania is reported about to let contracts on a large number of steel passenger cars. It is said that they will be somewhat larger than the 120 steel cars which were recently delivered to the Long Island Railroad by the American Car & Foundry Co.

The Tramway Rural a Vapor of Buenos Ayres, Argentine Republic, has ordered 85 cars from the J. G. Brill Co. Ten of these cars will be used for high-speed service and will be mounted on extra heavy trucks. The Brill Co. recently furnished 150 cars to the same company.

The Norfolk & Western is building at its Roanoke shops 300 hopper bottom gondola cars of 100,000 lbs. capacity. These cars weigh 38,000 lbs. and measure 34 ft. 6 in. long, 9 ft. 2 in. wide, and 10 ft. ½ in. high, over all. The special equipment includes: Christie brake-shoes, Westinghouse air-brakes, Butler draft rigging and Barber trucks. It will probably build 1,500 additional cars of the same type next year.

The Toledo, Peoria & Western has ordered 100 box cars of 80,000 lbs. capacity from the Pullman Co., for February, 1906, delivery. These cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The special equipment includes: Pullman axles and brasses, American Steel Foundry's bolsters, National-Hollow brake-beams, Westinghouse air-brakes, Tower couplers, Dayton draft rigging, Pennsylvania standard journal boxes, springs and trucks and Murphy roofs.

The Cleveland, Cincinnati, Chicago & St. Louis, as reported in our issue of Oct. 13, has ordered 20 cabooses from the Pullman Co. and 20 cabooses from the American Car & Foundry Co. These are for December delivery. They will weigh 24,500 lbs. each and will measure 23 ft. 6 in. long by 9 ft. 1¾ in. wide by 14 ft. 6¾ in. high over all. The special equipment includes National-Hollow brake-beams; C., C., C. & St. L. standard brasses, door fasteners and paint, and McAlpine draft rigging.

The Duluth & Iron Range has ordered 500 steel hopper bottom ore cars of 100,000 lbs. capacity from the Pressed Steel Car Co., instead of 750, as reported in our issue of October 6. These cars are for March, 1906, delivery, and will weigh about 32,000 lbs., measure 22 ft. long and 9 ft. 6 in. high, inside measurements. The special equipment includes: Simplex bolsters, Pressed Steel Car Co.'s brake-beams, Streeter steel back brake-shoes, Westinghouse air-brakes and draft rigging, Franklin dust guards, McCord journal boxes and Pittsburg Spring & Steel Co.'s springs.

The Cleveland Electric, as reported in our issue of October 6, has ordered 50 convertible passenger cars from the J. G. Brill Co. These cars will be 35 ft. 6 in. long, inside; 8 ft. 2¼ in. wide over posts, and 12 ft. high from rail to top of roof. The special equipment includes: Cleveland Electric Railway Co.'s axles and brake-shoes, Brill brake-beams and trucks, National Electric Co.'s air-brakes, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Dayton Manufacturing Co.'s door fastenings, Sherwin-Williams Co.'s paint, Monitor roofs, and Standard Car Wheel Co.'s wheels.

The Central of New Jersey, as reported in our issue of October 13, has ordered 1,000 low-side wood gondola cars from the American Car & Foundry Co., 1,000 steel underframe box cars from the Standard Steel Car Co., and 1,000 steel hopper coal cars from the Cambria Steel Co. The gondolas will have a capacity of 80,000 lbs. and will measure 34 ft. 4 in. long x 2 ft. 6 in. wide x 8 ft. 6 in. high inside; over-all dimensions will be 36 ft. long x 9 ft. 11 in. wide. The box cars will have a capacity of 60,000 lbs. and will weigh about 38,600 lbs. and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. 1¼ in. high inside; the over-all dimensions will be 37 ft. 3½ in. long x 9 ft. 8 in. wide x 13 ft. 4½ in. high. The hopper coal cars will have a capacity of 80,000 lbs. and will weigh about 36,700 lbs. and measure 30 ft. long x 9 ft. 5⅝ in. wide inside; the over-all dimensions will be 31 ft. 6 in. long x 10 ft. wide x 10 ft. 2 in. high. The special equipment for all of the above cars will include: Steel underframes, Westinghouse brakes, M. C. B. brasses, Tower couplers and Barber arch bar oscillating trucks. The box cars will be fitted with Kewanee brake-beams and the coal cars will be fitted with Diamond adjustable brake-beams.

BRIDGE BUILDING.

AKRON, OHIO.—Bids are wanted October 28 by the County Commissioners for building an iron bridge 60 ft. long with 16-ft. roadway and a 4-ft. sidewalk on stone or concrete foundations. M. D. Buckman is County Auditor.

BROWNSVILLE, TEX.—The St. Louis, Brownsville & Mexico will soon locate a site for the proposed bridge to be built either from this place or some other point on the American side over the Rio Grande river to a point in Mexico.

CHATTANOOGA, TENN.—The Chattanooga Company, Ltd., and others are agitating the question of building a railroad bridge over the Tennessee river.

DENVER, COLO.—Bids are wanted November 8 at the office of the Engineer, U. S. Reclamation Service, Chamber of Commerce Building, Denver, for building concrete culverts, bridge abutments and 10 combination highway bridges and furnishing 570,000 tons of steel. The work is to be done on the line of the Interstate canal from Whalen to Torrington, Wyo. Plans are on file at the office of the Chief Engineer of the Reclamation Service at Washington, D. C.; also with John E. Field, Engineer, Denver, Colo.

DULUTH, MINN.—The Lake avenue viaduct, it is said, will be repaired at a cost of $13,000. T. F. McGilvray is City Engineer.

FREDERICTON, N. B.—A steel bridge on stone piers will be built to replace the Mt. Whatley bridge connecting Nova Scotia and New Brunswick. Plans are also being made for a bridge to have a draw span to replace the Palmer Pond bridge in the parish of Dorchester.

Surveys are being made to locate the site for a bridge to be built over the St. John river at Hawkshaw.

GREENFIELD, IND.—Bids are wanted October 23 by William I. Garriott, County Auditor, for building a steel bridge 70 ft. long, known as the Harlan bridge, over Sugar creek; also for a steel bridge 75 ft. long, to be known as the Moorehead bridge over the Brandywine in Center township, and a steel bridge 100 ft. long over Sugar creek in Green township.

LANCASTER, PA.—Bids are wanted October 30 by the Commissioners of Lancaster County for the superstructure of a highway bridge over Big Beaver creek, near Refton. M. G. Schaeffer is Comptroller.

MEMPHIS, TENN.—Bids are wanted November 6 by Shelby County, Tenn., Levy Commission for building two 50-ft. steel highway bridges on concrete piers, one 20-ft. steel highway bridge, 1,065

ft. of steel highway trestle, and raising 227 ft. of steel truss highway bridge. Charles A. Barton is engineer for the commission.

New Market, Ala.—Bids are wanted November 6 by Madison County Commissioners, at Huntsville, for building a steel bridge on the New Hope road.

Ottawa, Ont.—The contract has been given to the Steel Concrete Construction Co., of Montreal, for building the concrete bridge about 400 ft. long, to cost $20,000, over the Rideau river, two miles from Ottawa, in the county of Carleton. Charles MacNab is County Clerk.

Port Huron, Mich.—Bids are wanted November 3 by the City Comptroller for building the unfinished portion of the canal from Lake Huron to Black river. The work includes 270,000 yds. of excavation, building a railroad bridge to carry two tracks, one highway bridge, a water gate and 350 ft. of protection pier. R. D. O'Keefe is Superintendent of Public Works.

Sanatoga, Pa.—The County Commissioners are selecting the site for the 400-ft. bridge to be built over the Schuylkill river, between this place and Frick's Locks.

Seymour, Texas.—The Wichita Valley Railroad, which is building an extension from Seymour to Stamford, will build a bridge over the Brazos river to cost $72,000.

South Bend, Ind.—Bids are wanted November 6 by the County Commissioners for building the concrete substructure and removing the Jefferson street bridge to Springbrook Park over the St. Joseph river, at a cost of about $26,000. W. J. Harbon is County Auditor.

Wichita, Kan.—Bids are wanted October 23 by C. N. Cartwright, County Clerk, for building a steel bridge.

Other Structures.

Adel, Ga.—The Georgia Southern & Florida Railroad has let the contract for building a new brick passenger station here.

Davenport, Iowa.—The various roads entering this city have agreed to jointly build a union passenger station.

Lancaster, Pa.—Bids are being asked by the Philadelphia & Reading for a new brick freight house, 31 x 171 ft., with a covered platform 110 x 10 ft.

Madison, Wis.—The Chicago & North-Western is planning to put up a new freight house here, at a cost of $70,000; also a new passenger station to cost $125,000.

Minneapolis, Minn.—According to reports, the Minneapolis, St. Paul & Sault Ste. Marie is planning to build a freight house here.

Montreal, Que.—A contract has been given by the Montreal Street Railway Company to the Canadian White Company, Ltd., for building large car sheds.

The Canadian Pacific, according to newspaper reports, will put up additions to its Angus shops at a cost of $52,350; also a building for its employees, 116 x 70 ft., to cost $32,000.

Ottawa, Ont.—The Grand Trunk Pacific is having plans prepared for a large passenger house which will be erected on the site of the present central station. It will extend over the canal by means of a large arch.

Ridgewood, N. J.—Announcement has been made that the Erie is planning to put up a new passenger station here.

Shoreham, Minn.—The Minneapolis, St. Paul & Sault Ste. Marie it is said will build additions to its shops here, to cost about $100,000.

West Nashville, Tenn.—The Nashville, Chattanooga & St. Louis will build a 100-ft. extension to its erecting shop; also a similar extension to its tender shop at a cost of $30,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alabama Western.—Articles of incorporation have been filed by this company to build a railroad from a point near Birmingham west to the Alabama-Mississippi state line. Entrance into the new union station at Birmingham can be made over the Southern's tracks. The officers of the new company are all Illinois Central officials.

Atlanta & Carolina.—Bids will soon be asked by this company for building its proposed road from Atlanta, Ga., east to Conyers, about 25 miles. The cost of the proposed work will be about $850,000. M. Mason is Chief Engineer, and M. T. Edgerton, Secretary, Atlanta.

Brownwood, Waco & Northern.—An officer writes that the prospects of building this proposed road are good. The route runs from Rising Star in Eastland County, Tex., south via May, to Brownwood, 30 miles, thence east through Hamilton, Cliffton and Valley Mills, to Waco, 125 miles. Contracts for grading will be let in about three months. The proposed road will pass through a level country. The officers have not yet been elected. (October 6, p. 111.)

Chicago, Rock Island & Pacific.—Surveyors of this company are in the field running three lines from Iowa City west to Des Moines, with the object of obtaining a more direct route for the main line. The surveyors have completed one line between these points, several miles south of the present road. Two other routes lying between the present line and the one just surveyed will be laid out.

Crooked Creek.—This road, formerly the Webster City & Southwestern, has been sold to a syndicate represented by a Mr. Seaman, of Milwaukee. The road is now in operation from Webster City, Iowa, southwest to Lehigh, 18 miles, and to the coal mines along the Des Moines river south of Lehigh. The new owners have arranged for the early construction of two extensions; one southwest from Lehigh to Gowrie, 15 miles, where connection will be made with the Northwestern, the Rock Island, Newton & Northwestern and the Minneapolis & St. Louis roads, and the other from Brushy, northwest to Fort Dodge, about 12 miles, to connect with the Illinois Central, the Chicago, Great Western, and other roads. The company has options on valuable land in Fort Dodge adjoining the properties of the Great Western.

Cumberland Railroad.—This company, which has nearly completed a 10-mile road into the Bush Creek coal fields of Knox County, Ky., is making surveys to build an extension of 17 miles into Jellico, Tenn. (See Construction Record.)

Detroit-Bay City Traction.—This company has filed a trust mortgage for $3,000,000 to cover a bond issue of that amount to build an electric line between Detroit and Bay City, Mich., 112 miles. The contract for the construction of tne road has been let to the Ross Construction Co., of Chicago, and a subsidiary company, the Wayne Construction Co., of Detroit, has been organized to carry on the work in Michigan. The contract calls for the completion of the road by Oct. 1, 1906. Construction work will begin at Bay City, run east to Akron and then south to Caro. It is planned to complete 32 miles this year. The officers of the company are: President, E. H. Whitcomb, Davenport, Ia.; Secretary, L. A. Rockwell, Detroit; Treasurer, C. H. Christian, Detroit.

Great Northern.—Work is being hurried on the extension from St. John, N. Dak., to Brandon, Man., and it is expected that trains will be running over the new branch this fall.

Houston & Texas Central.—This company has given a contract to W. S. Hipp, of Houston, for grading the whole of its new line from Mexia, Tex., south to Navasota. This line is to be built to overcome the heavy grades on the present line. Between these two points on the present line the distance is 110 miles.

Hudson Street Railroad.—Articles of incorporation have been filed by this company in New Jersey, with a capital of $3,000,000, to build and operate a street railroad in Jersey City, from Washington and Plymouth streets through various streets, 31 routes in all. The incorporators include: Pliny Fiske, of Rye, N. Y.; W. G. Oakman, of Roslyn; W. C. Fiske and A. Freedman, of New York City; David Young, of Newark, N. J., and William G. McAdoo, of Yonkers, N. Y. The company is understood to be affiliated with the "Hudson Companies," controlling tunnels from Jersey City to New York.

Illinois Central.—See Alabama Western above, and Yazoo & Mississippi Valley below.

James Bay.—The ratepayers of Parry Sound, Ont., have voted $25,000 bonus to this road on condition that the company establish a division point there with shops.

Jamestown, Diaz & Cherry Valley.—This company has been granted a charter in Arkansas, with a capital of $1,000,000, to build a railroad from Jamestown east through Diaz, in Jackson County, and thence to Cherry Valley, in Cross County, a distance of 65 miles.

Kanawha & West Virginia.—Contracts are reported let to Rinehart, Wyatt & Co., of Charleston, for building the proposed extension of this road from Bluecreek to Charleston, W. Va., a distance of 13½ miles. (September 8, p. 79.)

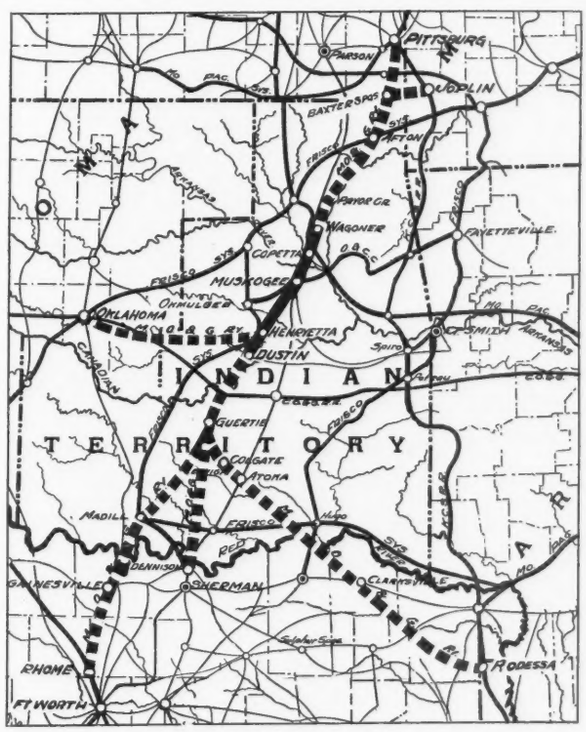
Kansas City, Mexico & Orient.—President Stilwell of this road is quoted as saying that grading between Eldorado and Emporia, Kan., a distance of 63 miles, is practically completed. The line between Wichita and Canton, Okla. T., a distance of 146 miles, is now in operation. Track has been laid from Sweetwater north to McCaulley, Tex., 25 miles, and this work will soon be finished to Rule, an additional 35 miles. From Sweetwater south to San Angelo, 27 miles, construction work is under way, 20 miles being completed. Track has been laid from Chihuahua, Mex., east for a distance of 74 miles, and this portion of the road was to have been put in operation the first of this month. From Minaca west

the road is nearly finished for a distance of about 40 miles, leaving a gap of about 150 miles through the Sierra Madre mountains to a connection with the line already built northeast for 73 miles from Topolobampo, on the Pacific coast. (September 15, p. 87.)

Keweenaw Central.—Arrangements, it is said, have been made for the funds to build the proposed extension of this road for a distance of 32 miles. A contract has been let to Frank Buschell, of Lake Linden, for building 12 miles, and work is to be started at once. (June 2, p. 183.)

Lake Shore & Michigan Southern.—Announcement has been made that preliminary plans are under way to relocate the line through Port Clinton, Ohio, to eliminate the curves. Much of the right of way has been secured. The work includes the building of a four-track bridge over the Portage river a mile west of the present structure.

Missouri, Oklahoma & Gulf.—This road, which operates a line 62 miles long from Wagoner, Ind. T., south to Henryetta, has recently completed an additional 13 miles from that point south to Dustin. An officer writes that a contract has been let for the grading and bridge work to J. W. Hoffman & Co., of Kansas City, Mo., for an extension of the road from Wagoner, its present northern terminus, north to Afton, 70 miles. The work will not be difficult. The maximum curvature will be 4 degrees. The work includes the building of four steel bridges and 2,000 ft. of trestles. The road is projected to extend north to Pittsburg, Kan., with a branch east to Joplin, Mo., on the northern end, a branch from



Missouri, Oklahoma & Gulf.

Henryetta west to Oklahoma City, Ind. T., and a branch from Dustin south to Guertie, where it will be divided into three sections, the western one to extend to Rhome, Texas, where connection will be made with the Fort Worth & Denver City; the central branch to Denison, Texas, and the eastern branch to Rodessa, La. (September 29, p. 103.)

Lake Superior & Southern.—An officer writes that this proposed road will run from Huron Bay, on Lake Superior, on the northern peninsula of Michigan, southwest via Lake Michigamme. Forty miles have been graded and bridges and culverts built. Track laying is to begin early next spring. Contracts will be let during the next six months for additional grading, track laying and bridge work. M. C. Phillips, of Oshkosh, Wis., is President, and George A. Young, of the same place, Construction Engineer. (October 6, p. 111.)

Las Vegas & Tonopah.—This company, which was recently incorporated in Utah with a capital of $4,000,000, will build a railroad from Las Vegas, on the San Pedro, Los Angeles & Salt Lake, through Lincoln, Nye and Esmeralda Counties to Tonopah, Nev., with connections to the mining camps at Bullfrog, Beatty, Rhyolite and Goldfield. The incorporators include: William A. Clark, of Butte, Mont.; W. H. Comstock, of Los Angeles; R. C. Kerens, of St. Louis, Mo.; C. O. Whittemore, of Salt Lake City, and others. Construction work is to be started at once.

Louisiana East & West.—An officer writes that this road, which has its northern terminus at Bunkie, La. (on the Texas & Pacific) and runs south through Eola, on the Southern Pacific, to Ville Platte, is probably to be extended to Rayne. As soon as the first 25 miles of this proposed extension is built, bonds to the amount of $250,000 will be sold to the Hibernia Bank & Trust Co., of New Orleans. Quarantine restrictions prevent the letting of contracts at present. The grading will consist entirely of earth work, as the line will run through a comparatively level country. C. J. Carpenter, Bunkie, La., is Superintendent. (September 29, p. 103.)

Minneapolis, St. Paul & Sault Ste. Marie.—An officer is quoted as saying that this road is planning to make extensive improvements in its terminals at Minneapolis. This company is now building 22 miles of side tracks and extensions.

Morgantown & Dunkard Valley (Electric).—Incorporation has been granted this company in West Virginia, with a capital of $300,000, to build a railroad from Morgantown, in Monongalia County, W. Va., west to Wadestown, 30 miles. The road may eventually be extended 12 miles south from this point to Mannington, passing through a rich agricultural section. W. W. Smith and George G. Johnson, of Morgantown, are interested.

Napa & Lakeport (Electric).—An officer writes that the route of this proposed electric railroad is from Napa, California, north through Napa, Conn, Chiles and Pope valleys via Middletown and Kelseyville, in Lake County, to Lakeport, about 75 miles. The contract for grading and track laying will be let in about six months when the final survey and location of the line has been completed. There will be 12 miles of heavy work. There will be one tunnel of 2,200 ft., one of 1,200 ft. and two of 500 ft. each. C. H. Miller is Chief Engineer, 209 Union Trust Building, San Francisco.

Nashville & Hopkinsville Interurban.—Bids may soon be asked by this company for building its proposed railroad from Nashville, Tenn., north to Hopkinsville, Ky., 78 miles. The company is considering the use of gasolene motor cars for passenger and freight service. F. L. DeMarco, Sheffield, Ala., is interested, and P. H. Hall, of Chicago, is Chief Engineer.

New York & Stamford (Electric).—This company, operating a line from New Rochelle, N. Y., northeast to Port Chester, 14 miles, which is controlled by the New York, New Haven & Hartford, has filed a certificate at White Plains seeking authority to build a line from Port Chester, west to White Plains, five miles. It is proposed to build the new line on private right of way.

Oklahoma & Northwestern.—Surveys have been completed by this company and grading work will be commenced at once by A. B. Sutton, the contractor in charge of construction work. The proposed route is from Elk City, Okla. T., on the Choctaw, Oklahoma & Gulf (Rock Island), north through Roger Mills, Day and Woodward Counties, to a point in Beaver County, about 100 miles, with a branch on the south to the south fork of the Red river near Sayre, about 15 miles. E. E. Niess is President and A. G. St. John, Chief Engineer, both of Chicago.

Ohio River & Gulf.—Surveys are being made for this proposed road, and five miles have been permanently located. The route is from Johnson Stand, Tenn., on the Tennessee Central, north to Jamestown, 34 miles, through a territory containing valuable timber, coal and oil fields. It is proposed eventually to extend the road north to the Ohio river near Louisville. The work includes the building of one bridge. Bids for building the road will be asked next month. William Cooper, of Maryland, Tenn., is President, and J. E. Jones, of Monterey, Tenn., Secretary and Treasurer. Major R. J. Moscrep, of Maryland, Tenn., is the engineer in charge of the work.

Oklahoma Central.—An officer writes that this road, which was formerly the Canadian Valley & Western, has commenced grading work on its proposed road from Lehigh to Chickasha, Ind. T. A contract has been given to the Canadian Valley Construction Co., of Lehigh. The line is practically level, with four degrees of maximum curvature. The work includes the building of seven girder bridges. R. L. McWillie, of Lehigh, Ind. T., is Chief Engineer.

Pittsburg & Cross Creek.—A contract is said to have been given by this company to the Gianini Construction Co., of Pittsburg, for building its proposed connection from the Wabash-Pittsburg Terminal to Burgettstown, in Washington County, Pa. (August 25, p. 63.)

Saint Maurice Valley.—A contract has been given by this company to Ross & McRae for building its proposed road from Three Rivers, Que., northwest via Shawinigan Falls, on the Great North-

ern of Canada, to Grand Mere, 22 miles. J. A. Aldred is Vice-President.

South & Western.—A contract is reported let by this company to the Carolina Co., of Bristol, Tenn., for building its proposed road from the coal fields of southwest Virginia through Virginia, Tennessee and North Carolina to a connection in South Carolina with the Southern, the Seaboard Air Line and the Atlantic Coast Line, a total length of 300 miles of main line. (October 6, p. 112.)

Southern.—W. J. Oliver, of Knoxville, Tenn., who has the contract for double track work on this road east of Knoxville, has sublet part of the work as follows: To McCreary & Co. for the first 10 miles; to Donaghy & Co. for the second 10 miles, and to J. E. Borches Co. for two miles. The work will soon be commenced. (September 29, p. 104.)

This company has given a contract to the Callahan Construction Co., of Knoxville, Tenn., for building six tracks from Shark's Gap to Lonsdale, Tenn., a distance of about six miles.

Union Pacific.—See Yellowstone Park below.

Union Traction Company of Iowa (Electric).—This company has been organized in Iowa, with a capital of $100,000, and office at Marshalltown. The company is to build an electric railroad from Marshalltown north to Grundy Center, thence northeast to Waterloo, Iowa, and another line from Marshalltown south to Newton, Iowa, where connection is to be made with the Interurban Railway Company of Des Moines, which will extend its Des Moines-Colfax line from Colfax to Newton. The total length will be 78 miles. The officers are: D. T. Denmead, of Marshalltown, President; J. E. Sedgewick, of Waterloo, Vice-President; L. C. Norris, of Marshalltown, Secretary, and George E. Lichty, of Waterloo, Treasurer.

Yazoo & Mississippi Valley (Ill. Cent.).—This company has filed a statement changing the route of its proposed Silver Creek extension. The new line has been located. It runs from a point on the Yazoo & Mississippi Valley at Silver Creek, in Yazoo County, Miss., southwest, following Silver creek and crossing Big Sunflower river at Holly Bluff, just west of Campbellsvile, and it will reach the main line at Valley Park, Kelso or some other station in that section. (May 19, p. 167.)

Yellowstone Park (Union Pacific).—An officer writes that grading work is under way on this proposed road, which has been located from St. Anthony, Idaho, southeast to Marysvale, 18 miles. The Utah Construction Co. has the grading contract for this portion of the work. W. H. Bancroft is President, and William Ashton, Chief Engineer, both of Salt Lake City, Utah. (September 29, p. 104.)

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—The proceeds of the sale of the $32,420,000 50-year 4 per cent. convertible bonds of 1955, which are a part of the $50,000,000 authorized, will be used for the completion of lines in the course of construction, for double tracking and reduction of grades, and for additional equipment. Of the amount realized on these bonds, the company has already authorized an expenditure of $9,300,000 for additional equipment and $9,500,000 for the completion of lines now in the course of construction. (January 27, p. 32.)

Boston & Maine.—The stockholders have voted to issue $10,000,000 4 per cent. 20-year refunding bonds to refund at maturity $7,774,500 bonds maturing September 1, 1906, and $2,000,000 maturing October 1, 1906. They also voted to issue $152,000 4 per cent. 20-year bonds for the purchase of the franchise, property, etc., of the Danvers Railroad, and $306,000 4 per cent. 20-year bonds to reimburse the B. & M. for the payment of $300,000 which it made in taking over the funded debt of the Newburyport Railroad, which runs from Bradford, Mass., to Danvers, 27 miles, and is leased by the B. & M. The Danvers Railroad runs from Wakefield Junction, Mass., to Danvers, 10 miles, and is also leased by the Boston & Maine, which owns its $125,000 bonds.

Central of Georgia.—The New York Stock Exchange has listed $1,052,000 first-preference income 5 per cent. coupon bonds of 1945, $2,952,000 second preference and $1,944,000 third preference.

Central Pacific.—The New York Stock Exchange has listed an additional $2,941,000 first refunding mortgage 4 per cent. guaranteed bonds of 1949, making the total amount listed $79,292,000.

Cleveland, Cincinnati, Chicago & St. Louis.—An additional $4,727,900 of common stock has been listed on the New York Stock Exchange, making the total amount listed $35,597,600.

Consolidated (N. Y., N. H. & H. electric lines).—The managers of this company are arranging to do an express (parcel) business, and have organized The Trolley Express Co., with $100,000 capital. The entire capital stock will be owned by the Consolidated.

Duluth, South Shore & Atlantic.—The operations for the year ended June 30 resulted in a deficit of $206,552, this being a decrease of $76,899 as compared with 1904. The gross earnings were $2,706,936, an increase of $182,324, and expenses, $1,852,705, an increase of $103,249. Gross earnings from freight increased $245,842, while passenger earnings decreased $60,235. The increase in operating expenses was in maintenance of way and in maintenance of equipment; the cost of conducting transportation decreased.

Great Northern.—The proceeds of the sale of the $25,000,000 new capital stock sold to the stockholders at par will be used to repay the $7,500,000 short-term notes issued recently, and also to pay for extensions of lines in the northwest. (October 13, p. 120.)

Gulf & Ship Island.—The annual report of this company for the year ending June 30 shows a deficit of $47,804. This unfavorable showing is due to the interruption of traffic caused by the storms in the early part of 1905. The gross earnings were $1,877,397, an increase of $48,582; but expenses increased $168,007, which made the net earnings $480,155, a decrease of $120,425. The net income was $179,450, a decrease of $153,863. It is equivalent to 3 per cent. on the $6,000,000 capital stock; and since a dividend of 4 per cent. was paid this left a deficit. During the year the capital stock was increased $500,000, and the funded debt $165,000. The average number of miles operated during the year was 275.

Hampshire & Worcester (Electric).—This road, which runs from West Brookfield, Mass., northwest to Ware, 12 miles, and has been in the hands of a receiver, has been sold to the American Loan & Trust Co., of Boston, for $5,000 over and above encumbrances. (September 8, p. 80.)

Lehigh Valley.—This company has bought the property of Coxe Bros. & Co., Inc., the largest independent coal operators in the anthracite fields. This includes the Delaware, Susquehanna & Schuylkill Railroad, which is 49 miles long and runs from Drifton to Gowen, Pa., 31 miles, with 18 miles of branches and 133 miles of trackage rights, over the Lehigh Valley, from Penn Haven Junction to tidewater at Perth Amboy. The Delaware, Susquehanna & Schuylkill has no bonds and $1,500,000 common stock, the last dividend on which was one of 9 per cent., and on which a dividend of 70 per cent. (50 per cent. stock) was paid in 1893. The purchase will be financed by an issue of $19,000,000 short-term collateral trust bonds, to be secured by pledge of the stock of Coxe Bros. & Co. and the Delaware, Susquehanna & Schuylkill. The annual tonnage which will be added to the Lehigh Valley's coal production will be in the neighborhood of 2,000,000 tons, or about 3 per cent. of the total annual anthracite production.

Louisville & Nashville.—The New York Stock Exchange has listed an additional $3,000,000 of the unified 50-year 4 per cent. bonds of 1940, making the total amount listed $37,562,000.

Pacific Coast.—The annual report for the year ended June 30 of this company, which operates a number of short lines near Puget Sound, shows a surplus of $482,996, an increase of $129,882. The net income was $1,109,246, amounting to nearly 9 per cent. on the $12,525,000 of capital stock. Of this amount, $626,250 in dividends were paid on the first and second preferred and common stock. The gross earnings were $6,199,276, an increase, over last year, of $296,303.

Toledo Railways & Light (Electric).—This company has declared another dividend of 1 per cent., making 2 per cent. for the year 1905, a 1 per cent. dividend having been paid last May. The earnings for the current year are at the rate of about 3½ per cent. yearly on the $11,000,000 capital stock.

Wabash.—At the annual meeting on October 11, Joseph Ramsey, Jr., voted on $3,804,200 of stock and $3,184,000 of debenture bonds. George Gould voted on $46,146,700 of stock and $22,851,000 of debenture bonds. As Mr. Ramsey voted cumulatively, that is, concentrated all his votes on one member of the board of directors instead of voting on all 13 directors, he was able to cast 526,386 votes toward the election of one director; but Mr. Gould, voting non-cumulatively, was able to cast 689,977 votes for each director.

Western Pacific.—The first payment of the semi-annual interest on the $50,000,000 first-mortgage 5 per cent. bonds of 1935 has been paid. The money for this payment was taken from the amount raised by the sale of the bonds themselves, and this will be done hereafter until the road is in operation. After that, the Denver & Rio Grande and the Rio Grande Western guarantee the payment of interest.